DRAFT ENVIRONMENTAL PERFORMANCE REPORT AND MANAGEMENT PLAN (EPRMP)

TOLEDO COPPER MINE

(Mine to Port Operations)

Brgy. Don Andres Soriano, Toledo City, Cebu

June 2022

CARMEN COPPER CORPORATION

May 27, 2022

Engr. WILLIAM P. CUÑADO
Director
Environmental Management Bureau
EMB Central Office
DENR Compound, Visayas Avenue
Diliman, Quezon City

Dear Director Cuñado:

Submitting herewith the Environmental Performance Report and Management Plan for Carmen Copper Corporation's ECC application for Toledo Copper Mines Integrated Mining and Processing Operations (Mine to Port Operations), also integrating all the ECCs that were issued for its various facilities/operations.

Very truly yours,

ALEXEI JEROME G. JOVELLANA
President and CEO

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ACRONYMS

ACMDC	Atlas Consolidated Mining and Development Corp.
A&D	Alienable and Disposable
AMD	Acid Mine Drainage
APSA	Application for Production Sharing Agreement
ARD	Acid Rock Drainage
CCC	Carmen Copper Corporation
CG-ABS	Cebrian Geokonsult Atlas Baseline Study
CNC	Certificate of Non-Coverage
DAS	(Barangay) Don Andres Soriano
DENR	Department of Environment and Natural Resources
ECC	Environmental Compliance Certificate
EIA	Environmental Impact Assessment
EMB	Environmental Management Bureau
EPEP	Environmental Protection and Enhancement Program
EPRMP	Environmental Performance and Management Plan
FMRDP	Final Mine Rehabilitation and Decommissioning Plan
IEER	Initial Environmental Examination Report
MGB	Mines and Geosciences Bureau
MMT	Multipartite Monitoring Team
MPSA	Mineral Production Sharing Agreement
NAF	Non Acid Forming [waste material]
PAF	Potential Acid Forming [waste material]
PNSDW	Philippine National Standard for Drinking Water
RIZ	Regional Impact Zone
SBDT	Sigpit Biga Drain Tunnel
SDMP	Social Development and Management Program
SEMP	Sapangdaku Environmental Management Program
TCM	Toledo Copper Mines
TDF	Tailings Disposal Facility
TSF	Tailings Storage Facility
WRD	Waste Rock Dump

EXECUTIVE SUMMARY

Project Fact Sheet

Name of Project	**Toledo Copper Mine (Mine-to-Port Operations)**
Project Location	The TCM covers the following Barangays Don Andres Soriano/Lutopan, Biga, Media Once, Loay, Daanlungsod, Poog, Cantabaco, Bagacay and Gen. Climaco-Toledo City, Province of Cebu
Nature of Project	Resource Extractive Industry and Mineral Processing Project: Metallic Mineral or Ore Processing
Project Size/Area	4,849.239 hectares - Integration of the following: *a)* 4,502.24 hectares: *MPSAs/APSAsMPSA 210-2005-VII (Carmen Mining Area), MPSA 264 2008-VII: (Lutopan Mining Area); MPSA 307-2009 VII; APSA 00044 VII: APSA 00046 VII, APSA 000196-PART* *b)* 132.5966 hectares: *Malubog Lake area* *c)* 201.767 hectares: *Pipeline ROW* *d)* 12.6374 hectares: *Atlas Port*
Project Scale	***Milling Output:*** The plant will be based on an initial throughput of *8,760,000 tons per annum and an output of 3,504 tons per annum* upgraded ore of 0.35%Cu grade but could be adjusted based on plant requirements. ***Open Pit Ore Extraction*** — 2021 — 2023 Total Ore Mine — 14,953,613 — 17,611,145 Total Waste Mined — 13,346,375 — 56,388,849 Total Material Moved — 28,299,988 — 72,999,995
CNC/ECC Issued	CNC (01-24-05) for the Mining Operations of ACMDC
	ECC 07-06 05-080079-104 (May 08, 2006)-Atlas Tailings Disposal System & Biga Pit Rehabilitation
	ECC 07-0612-290278 120 (Dec. 29, 2006) – Sigpit Creek (interim) and Biga Pit Disposal Facilities Project • Amended ECC 07-0612-290278 120 (Dec. 28, 2011)-Biga TSF Impounded Water Relief Project • Amended ECC 07-0612-290278 120 (April 22, 2013)-Atlas Mines Tailings Disposal Facility and WRD • Amended ECC 07-0612-290278 120 (Oct. 21, 2018)-Biga Pit TSF Enhancement & Marcona WRD
	ECC RO7-1012-0379 (Jan. 25, 2011)-Airstrip Site WRD/Landfill • Amended ECC RO7-1012-0379 (Sept. 16, 2011)-Airstrip Site WRD/ Landfill Expansion

The Toledo Copper Mines is located in the City of Toledo, Province of Cebu and is within the three (3) Mineral Production Sharing Agreements (MPSAs), three (3) Application for Production Sharing Agreements (APSAs), and the properties of the Atlas Mines/ACMDC that covers the following barangays: Don Andres Soriano/Lutopan, Biga, Media Once, Loay, Daanlungsod, Poog, Cantabaco, Bagacay and Gen. Climaco-Toledo City, Province of Cebu. The port facility is located in Brgy. Daanlungsod.

Carmen Copper Corporation (a subsidiary of ACMDC) revived the Toledo copper mining operation and used a total area of 1,674.0479 hectares, covering 32% of the ACMDC property under CCC-ACMDC Operating Agreement.

The Atlas Mines was issued a CNC, however, areas undergoing improvement and expansion were procured ECCs (such as the Waste Rock Dumps and Tailings Disposal Facilities).

Recently, the Toledo Copper Mines was about to undertake the following: a) Apply for an ECC for the proposed upgrading of the Carmen Concentrator (Carcon) facility, and b) Apply for an ECC Amendment for its Airstrip Site WRD modifications.

However, it is being recommended to integrate all the existing ECCs issued into one ECC that will cover the entire Mining and Processing operations (mine to port) of Toledo Copper Mines.

The major components of the Toledo Copper Mines are as follows:

1. The Carmen Pit covers an area footprint of 2,430,000 square meters and a capacity of 188.22 million metric tons. Mining operations/ore extraction is currently concentrated on Carmen Pit – the primary source for commercial productionSouth Lutopan Pit . with a minable reserve of 14,539
2. Lutopan Pit . The Lutopan Pit covers an area footprint of 1,021,200 square meters and ore capacity of 26.42 million tons. The Lutopan Pit comprises the South and North Lutopan Pit. Planned activities for Lutopan Pit are as follows: stripping is programmed to start at B+345 by 2029 onwards. Carmen Concentrator (CarCon) Facility.
3. Carmen Concentrator Facility occupies a land area of 84.32 hectares with building/facility/infrastructure footprint of 20.07 hectares. (consisting of 16.9 hectares with existing buildings/facilities with 31 hectares allocated for proposed developments
4. **Tailings Disposal Facilities.** The disposal method is essentially a tailings transmission and containment system that utilizes the Biga Pit as the placement site for tailings. Capacity of the BTSF - The current ECC indicated that the total volume of available void between two horizons of 168,716,000 cu.mtrs, equivalent to an impounding capacity of 252,000,000 tailings tonnages at peak milling capacity for 42,0000 metric tons/day of ore of Carmen Concentrator. With this enhancement project the impounding capacity of the BTSF will be increased to 213,235,123 cu.mtrs (DMT) or 341,176,197 tons (at elevation 420m.)
5. Waste Rock Dump/Landfill Facilities The Toledo Copper Mines has a number of old/abandoned wastes dumps and WRD facility that is currently being utilized (Airstrip Site WRD) and the proposed Marcona WRD.
6. Port Facility. The Port Facility, operated by ACMDC since 1955 is located in Brgy Daanlungsod within the urban district of the City of Toledo. The port facility, which primarily handles copper concentrates from the mine site's Carcon facility (about 14 kilometers distant), for transport and delivery to various clients/buyers destinations.

General Mining Process The mining process for metal extraction usually consists of two parts: mining and milling. The mining component is the extraction of metal-bearing ore from rock. The milling component generally crushes, grinds and extracts a concentrate in a series of mechanical and/or chemical processes

Considering the entire land area/vast landholdings of the mining company, the landform as described in the Maunsell Study in 2001, basically, is the predominant general situation of a mining area, except for the areas where there are ongoing mining ore extraction (such as the Carmen pit), active waste rock dumps and other mining operations. The Toledo Copper Mines has substantial areas with remaining forest cover, reforested and rehabilitated sites, and areas currently undergoing and program for rehabilitation and reforestation in the years to come. The

land use zoning classification of the project site, per CLUP is 'Mining Area', while the rest of Barangay Biga is zoned as 'Agroforestry'.

The TSF enhancement (particularly, the construction of the dam/dike in Biga Pit's north face) and the Marcona WRD development will have the following potential adverse impacts: land clearing will involved removal/cutting of planted trees within the reforestation area; removal of trees and soil disturbance will cause erosion, landslide, and siltation/sedimentation of waterways; Existing land use pattern within the primary and secondary impact area will be modified, particularly, on the change of land use from reforestation area to construction site of the dike and permanent diversion of routes/road network.

A number of water quality studies provided historical reference/comparison on the baseline environmental conditions, such as the improvement of the quality of drainage waters from the 2008-2009 baseline study to the GHD 2011 study. The MMT conducted regular monitoring-sampling but the parameters sampled were limited. Two major concerns were noted in the studies, namely: flooding and the quality of water discharges from the Biga TSF. Of particular concern for the Marcona WRD is the perceived flooding of the areas near the foot of the WRD from drainage/stormwater flows.

Air (dust) and noise are critical concerns raised by the Brgy. Biga residents especially those residing near the proposed Marcona WRD.

People's safety and risks from dangers of structural failures of the Biga TSF and Marcona WRD (which may lead to flooding, landslide), affected households and farmed/cultivated crops within the Marcona WRD are concerns of the community that needs to be addressed.

Existing environmental management measures will be continued and additional enhancement measures will be proposed to address the identified potential adverse impacts – the mitigation and enhancement measures are noted in this EPRMPs Environmental Impact Management Plan (EIMP)

Phase	Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency
LAND				
Construction/deleopment of the additional/modified carcon facility, expansion/modification of airstrip wrd	Soil	Removal, disturbance of top soil during land clearance for the affected areas (development footprints of proposed modifications)	The soil will be stockpiled and retained for future revegetation programs. (This will be done on appropriate areas affected by development activities)	60% stockpiled of removed soil for future applications 40% utilized for on-going reforestation projects & landfilling of depressed areas
		Contamination of soils from spilled fuel, oils and lubricants from construction vehicles	• Develop & implement emergency response procedures which will specify the steps to be taken in the event of fuel or oil spill • Standard maintenance & clean-up procedures	100% compliance to RA 9275 & its IRR, DAO 2013-22
	Land use	Land use in and around the construction area will become restricted area. Existing land use such as 'forestal, marginal agriculture' will be affected	• Safety warning signs shall be put-up • Limited access shall be provided if necessary for barangay residents within TCM (such as passing through an access road)	100% implementation of safety measures
	Landscape and Visual Character	Alteration of visual character of the area due to removal of vegetation and the top soil	• Limit removal of trees in areas identified for development. • Proper utilization of harvested trees, i.e. Donate lumber/fire wood to affected communities. • conduct immediate rehabilitation/revegetation of the affected areas.	100% implementation of reforestation programs/projects
	Flora & Fauna	Removal of vegetation, site clearing and grading for development footprints of the Carcon facility, Airstrip WRD expansion and other future construction activities causes loss of habitat for small mammals, birds and insects	To prepare a fauna management plan, that includes the following measures: *conduct fauna/wildlife inventory; fauna monitoring; return of fauna habitats to rehabilitated areas; translocation of fauna; establish a protected wildlife habitat area*	100% preparation of faunal management plan
OPERATIONS	Soil/Ground Permeability	Leaching of pollutants/heavy metals at Biga Pit's bottom causing soil and groundwater contamination	• Regular monitoring of ground and surface water quality; • Identify water quality sampling sites for regular monitoring for the possibility of ground and aquifer contamination.	100% implementation of monitoring plan and compliance to other regulations, eg. Discharge permit, handling/ disposal of Hazarodous & toxic wastes
Operations	Soil	Soil Erosion and sedimentation degrading surface (river) water quality. Surface run-off causing erosion and transporting sediments from surrounding areas going into the peripheral drainage canals and the Biga Pit itself	• Retain sediment on-site (within Toledo Copper Mines) through putting-up of sediment pond or a series of catch basins for the peripheral stormwater run-off drainage canal to prevent sediments from going into the Cumba River and other drainage outfalls. • Improve/enhance drainage system immediately surrounding project sites (Carcon facility, Airstrip WRD) and existing and future developments	100% maintenance of siltation ponds and drainage systems
		Loss of soil fertility & potential amenity for agriculture/forestal through erosion/sedimentation and contaminated run-off from TSF	Adequate and proper compensation for loss of agricultural and forest lands and its potential for production-economic amenity	100% implementation of agreed compensation plan for affected residents/farmers (Once the Marcon WRD project will be implemented)
	Land Use pattern	Flooding of areas along waterways and its overall	Support Toledo City Government's program, particularly on the following projects: Rehab/protection, reforestation &	100% support to such notable projects

Phase	Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency
		effects on the river basin land use pattern	stabilization of riverbanks, river rechanneling, flood control and others	
	Landscape and Visual Character	Alteration of visual character of the area due to loss of vegetation and landform changes	Implementation of the approved annual reforestation/rehabilitation program.	100% implementation of refo/rehabilitation projects/programs
	Flora & fauna, People	Loss of vegetation, loss of habitat for small mammals, birds and insects	• Limit removal of trees in areas identified for development. • Proper utilization of harvested trees, i.e. Donate lumber/fire wood to affected communities. • If applicable, conduct immediate rehabilitation/revegetation of the affected areas. • Undertake biodiversity conservation programs within and the immediate surroundings of TCM	100% implementation of refo/rehabilitation projects/programs & development of biodiversity conservation plans/ programs
	Geotechni-cal Engg	Excessive erosion or failure of the WRDs and Dams (e.g Malubog & Biga)	• Establish and maintain an appropriate peripheral drainage. • Reforestation/rehabilitation of affected areas • Regular inspection of facility structural integrity	100% undertaking of improvement & maintenance of drainage system 100% conduct of regular inspection & maintenance works
Abandonment-Restoration	Land/soil, water contaminati on	To return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible -to eliminate significant adverse effects on nearby water resources	• Rehabilitation of the affected areas based on the programs stated in the approved FMRDP. • Slopes should be re-contoured to minimize erosion and runoff. • Planting of appropriate species of vegetation and/or other species of vegetation that are environmentally acceptable.	100% implementation of refo/rehabilitation projects/programs
WATER				
Construction	Surface water	Erosion of exposed topsoil by construction activities (removal of soil and woodland) may impact on surface watercourses through soil erosion and contamination	Establish and maintain an appropriate peripheral drainage.	100% undertaking of improvement & maintenance of drainage system
		Removal of soil and vegetation will change the nature of the watershed feeding the project watercourses	Implementation of the approved reforestation/revegetation program	100% conduct of regular inspection & maintenance works
		Contamination of water from the accidental release of hydraulic fluid, oil or fuel from construction vehicles	• Develop & implement emergency response procedures which will specify the steps to be taken in the event of fuel or oil spill (contractor) • Standard maintenance & clean-up procedures	100% compliance to RA implementation of monitoring plan and compliance to other regulations, eg. Discharge permit, handling/ disposal of Hazarodous & toxic wastes
	Groundw-ater	Contamination of groundwater from the accidental release of hydraulic fluid, oil or fuel from the construction vehicles	• Develop & implement emergency response procedures which will specify the steps to be taken in the event of fuel or oil spill • Standard maintenance & clean-up procedures	100% compliance to RA 6969, RA 9275 and conditions of the Discharge Permit

Phase	Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency
OPERATIONS	Hydrology/ Flooding	Discharges of Biga Pit overflow relief water influence excessive increase in volume of Sigpit river flow rates causing flooding in downstream (lower sigpit and sapangdaku) areas	• Control releases of discharges not to exceed the allowable limits/thresholds applied/covered by the issued Discharge Permit for the Biga TSF. • Management and control of Biga Pit discharge through the Biga TSF Decant System during heavy rainfall and storms/typhoons. • Consistent/efficient monitoring & feedback of weather/climate patterns (esp. weather disturbances, and amount of rainfall) • Implement Zero Waste Discharge	100% compliance to RA 6969, RA 9275 and conditions of the Discharge Permit 100% implementation of Zero-waste discharge program
	Hydro-geology	Penetration of pollutants/ heavy metals from Carcon Facility, Motorpool, work area, TSF, WRDs, erc.	• Regular monitoring of ground and surface water quality; • Identify water quality sampling sites for regular monitoring for the possibility of ground and aquifer contamination.	100% compliance to RA 6969, RA 9275 and conditions of the Discharge Permit 100% implementation of Zero-waste discharge program
	Water Quality	Transport of water-borne contaminants from Carcon Facility, Airstrip & other WRDs, Motorpool, work area, Biga TSF, erc.	• Provision of Sedimentation/Settling Pond/ Water Treatment facility (after or before the Decant Tower. ***Location/Capacity of Settling Pond: Sigit (52,562 cum, Udlom Settling Pond, Emergency Tailings Pond (35,737.72 cum)*** • Dilution by the water inflow • Dilution by lime additive (if pH increases) • Water recovery & treatment (if needed) • Physical & chemical treatment for specific type of pollutants (e.g phosphate & nitrates) which may exceed the standards) (if needed/necessary)	100% compliance to RA 6969, RA 9275 and conditions of the Discharge Permit 100% implementation of Zero-waste discharge program 100% implementation of maintenance works for settling ponds
		Soil Erosion and sedimentation increases suspended particulates in surface water. degrading surface (river) water quality. Surface run-off causing erosion and transporting sediments from surrounding areas going into the peripheral drainage canals and the Biga Pit itself	Implement Erosion & Sedimentation Control (ESC) Measures/Plan that includes, among others: • Retain sediment on-site (within TCM) through putting-up of sediment pond or a series of catch basins (berms and silt traps) for the peripheral stormwater run-off drainage canal to prevent sediments from going into the Cumba River and other drainage outfalls. • Improve/enhance drainage system immediately surrounding Biga Pit (right after road) through the following: a) road side (Biga Pit side) drainage canal with cross-drains for run-off to be directed to the opposite canal (leading to River outfall) and not to Biga Pit	100% implementation of ESC measures/plan
AIR				
CONSTRUCTION	***AIR***. Air pollution	*generation of dust form movement of haul trucks & other heavy equipments*	• Active areas will be routinely sprayed with water in order to suppress dust. **Frequency of Spraying:** ***1*** *pass in the morning and 1 pass in the afternoon. However, during dry season it is adjusted to 2 passes both in the morning and afternoon or as need arise.* • Preservation and planting of trees, vegetation around the TSF as buffer/tree filters	100% compliance tp RA 8749 & DAO 2000-81 100% implementation of spraying schedules 100% implementation of reforestation program

Phase	Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency
OPERATIONS	***AIR***. Air pollution	*effects of air pollutants on nearby areas; dusts generation from dumping & wind-induced erosion of dumps*	• Active areas will be routinely sprayed with water in order to suppress dust. **Frequency of Spraying: *1*** *pass in the morning and 1 pass in the afternoon. However, during dry season it is adjusted to 2 passes both in the morning and afternoon or as need arise.* • reforestation/rehabilitation of affected areas after completion of the activity.	100% compliance tp RA 8749 & DAO 2000-81 100% implementation of spraying schedules
		contamination of air due to dust emissions from vehicles & trucks operating on dirt roads	• Water spraying will be conducted on all affected roads. **Frequency of Spraying: *1*** *pass in the morning and 1 pass in the afternoon. However, during dry season it is adjusted to 2 passes both in the morning and afternoon or as need arise.*	100% compliance tp RA 8749 & DAO 2000-81 100% implementation of spraying schedules
	Noise & Vibration	Noise and vibration caused by TSF activities disturb wildlife	Proper scheduling ***(within the 8am-5pm daylight***) of activities so as not to cause disturbance to wildlife	100% compliance to working hours schedule
	LAND/Soil, air, water contaminati on	Accidents, damaged to infrastructure - soil, air and water contamination, and damaged to infrastructures	• Implement proper maintenance on all affected roads • Implement speed limits in all areas • Water spraying will be conducted on all affected roads. **Frequency of Spraying: *1*** *pass in the morning and 1 pass in the afternoon. However, during dry season it is adjusted to 2 passes both in the morning and afternoon or as need arise.*	
	WASTE MANAGE-MENT Soil, air, water conta-mination	Generation of industrial waste-scrap metal, empty containers, etc., that will be generated from TSF operations	Prepare a waste management plan, that, among others, will provide guidelines & procedures of proper waste management	
		Reusable materials should be reused or recycled to reduce amount of waste generated	Establish and maintain storage areas for reusable materials; reusable materials include empty drums, timber, etc. these will be reused by the quarry, sold or donated to interested parties. ***MRF Capacity 60,000 cu.m. @ Location 20/Minesite***	100% compliance to RA 9003, RA 6969 and their IRR/guidelines 100% installation & operation of MRFs
		Prevent hazardous waste from contaminating soils and water	Hazardous wastes will be stored in a secure area. Disposal will be trough accredited Treatment and Storage Service Providers. ***A number of HazWastes facilities are in-placed (see Section 2.1..1..5, Table 2.6, p. 110 for location and capacity)***	100% compliance to RA 9003, RA 6969 and their IRR/guidelines 100% installation & HazWastes Storage Facility
Abandonment Restoration	Land/soil, water contaminati on	return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible -to eliminate significant adverse effects on nearby water resources	• Rehabilitation of the affected areas based on the programs stated in the approved FMRDP. • Slopes should be re-contoured to minimize erosion and runoff. • Planting of appropriate species of vegetation and/or other species of vegetation that are environmentally acceptable. Planting initially of nurse species ***(Auri, Mangium, Crassicarpa) and to be enriched with pioneer native trees)***	100% implementation of rehabilitation and reforestation programs
PEOPLE				
Constructio n	***PEOPLE***. Hazards, accidents	**Public Safety** *To prevent inadvertent access by the public into work areas*	Inform public of dangers of entering construction site through public consultation, liaison with the barangay/municipal leaders, display of notices and warning signs	100% implementation of Safety and Security Measures

Phase	Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency
		To provide continuous and convenient access to public infra (e.g. road) To avoid disruption to people/community activities (e.g. farming)	• Pipeline construction along roads (right of way) where the local community inside Toledo Copper Mines regularly uses, should not be closed/restricted & disruption of local transport should be avoided • Safety and warning signs shall be put-up • Construction works shall not affect, disrupt or destroy agricultural/farmlands of the local community. In cases where this cannot be avoided, the farmer/tiller shall be adequately compensated	100% implementation of Safety and Security Measures
Operations	***PEOPLE*** Risks, hazards and safety concerns for nearby communities	To address the nearby communities concerns and welfare	• To undertake more consultations and solicit full participation of the communities in updating of CCC SDMP • To compensate for loss of livelihood which may be affected by the project • To provide warning signs and safety devices(e.g. fencing) around Biga Pit to prevent accidental fall (of people using the peripheral road around Biga Pit which may venture into the pit's rim) • Establish and maintain an appropriate Emergency and Preparedness Response Program covering all critical areas (Malubog Dam, Biga TSF, etc.)	100% implementation of SDMP 100% implementation of Safety and Security Measures 100% implementation of Emergency and Preparedness Response Program
		To address the possibility of disastrous flooding influence by excessive discharges of Biga Pit overflow relief waters and accidental releases of tailings	• Adequate and proper compensation for loss, destroyed, damaged, farmlands, crops, properties, etc • CCC involvement in community disaster risk management initiative • Immediately conduct clean up of the affected river systems and coastal areas. Likewise, appropriate rehabilitation of the affected river and coastal areas will be implemented after the clean up; and • Affected farmers and community members will be justly compensated of their damages. • Establish and maintain an appropriate Emergency and Preparedness Response Program covering all critical areas (Malubog Dam, Biga TSF, Waste Rock Dumps, etc.)	100% compliance to agreed compensation package for affected households 100% implementation of SDMP 100% implementation of Safety and Security Measures 100% implementation of Emergency and Preparedness Response Program
Abandonment Restoration	Land/soil, water contaminati on	-To return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible -to eliminate significant adverse effects on nearby water resources	• Rehabilitation of the affected areas based on the programs stated in the approved FMRDP. • Slopes should be re-contoured to minimize erosion and runoff. • Planting of appropriate species of vegetation and/or other species of vegetation that are environmentally acceptable.	100% implementation of reforestation plan/program

PART 1: PROJECT INFORMATION AND DESCRIPTION

1.1 Project Information

1.1.1 Brief Project Information

Name of Project	**Toledo Copper Mine (Mine-to-Port Operations)**
Project Location	The TCM covers the following Barangays Don Andres Soriano/Lutopan, Biga, Media Once, Loay, Daanlungsod, Poog, Cantabaco, Bagacay and Gen. Climaco-Toledo City, Province of Cebu
Nature of Project	Resource Extractive Industry and Mineral Processing Project: Metallic Mineral or Ore Processing
Project Size/Area	4,849.239 hectares - Integration of the following: *e)* 4,502.24 hectares: *MPSAs/APSAsMPSA 210-2005-VII (Carmen Mining Area), MPSA 264 2008-VII: (Lutopan Mining Area); MPSA 307-2009 VII; APSA 00044 VII: APSA 00046 VII, APSA 000196-PART* *f)* 132.5966 hectares: *Malubog Lake area* *g)* 201.767 hectares: *Pipeline ROW* *h)* 12.6374 hectares: *Atlas Port*
Project Scale	***Milling Output:*** The plant will be based on an initial throughput of *8,760,000 tons per annum and an output of 3,504 tons per annum* upgraded ore of 0.35%Cu grade but could be adjusted based on plant requirements. ***Open Pit Ore Extraction*** — 2021 — 2023 Total Ore Mine — 14,953,613 — 17,611,145 Total Waste Mined — 13,346,375 — 56,388,849 Total Material Moved — 28,299,988 — 72,999,995
CNC/ECC Issued	CNC (01-24-05) for the Mining Operations of ACMDC
	ECC 07-06 05-080079-104 (May 08, 2006)-Atlas Tailings Disposal System & Biga Pit Rehabilitation
	ECC 07-0612-290278 120 (Dec. 29, 2006) – Sigpit Creek (interim) and Biga Pit Disposal Facilities Project • Amended ECC 07-0612-290278 120 (Dec. 28, 2011)-Biga TSF Impounded Water Relief Project • Amended ECC 07-0612-290278 120 (April 22, 2013)-Atlas Mines Tailings Disposal Facility and WRD • Amended ECC 07-0612-290278 120 (Oct. 21, 2018)-Biga Pit TSF Enhancement & Marcona WRD
	ECC RO7-1012-0379 (Jan. 25, 2011)-Airstrip Site WRD/Landfill • Amended ECC RO7-1012-0379 (Sept. 16, 2011)-Airstrip Site WRD/ Landfill Expansion

1.1.2 Proponent Information

Proponent Name	**Carmen Copper Corporation**
Address	DAS, Toledo City
Authorized signatory/ representative to apply for ECC	**ALEXIE JEROME JOVELLANA** President & CEO CHRISTOPHER JOHN W. SALCEDO Manager, Environment Division
Contact Details	+63 9173261021, cwsalcedo@carmencopper.com

Vision & Mission Statement. Carmen Copper Corporation aims to be the leading copper producer in the Philippines, a preferred employer in the industry and a role model for responsible mining and good governance. Anchored on this vision, Carmen Copper will enhance value for its shareholders by pursuing long-term prospects for stability, growth and diversification while harmonizing safe and efficient business practices with the social and environmental needs of its host communities.

Brief Historical Background. Atlas first acquired the Toledo property from another company in 1953. In August of that year, construction of a 3,600-metric ton per-day (MTPD) concentrator commenced. In February 23, 1955, the first truckload of ore from the Lutopan open pit was delivered to the mill.

By 1962, as a result of continuous expansion of Atlas' mining and milling capacities, its concentrator was treating 15,000 MTPD of ore. In that year too, the first underground (UG) mine was developed and on June 19, 1966, ore production from the UG block-caving operation commenced at 5,000 MTPD and finally attained 11,000 MTPD in 1968.

In 1969, the 32,000 MTPD Biga concentrator project began and, two years later, started production. Atlas at that point in time had expanded its mine and milling capacities to 66,000 MTPD or about 18 times its original tonnage. In servicing the huge operations, the company also improved and expanded its support facilities, such as the 5.4 billion-gallon Malubog Dam water reservoir, the 93.5-megawatt power plants, its port facility, lime plant, iron and steel foundry, and a bustling community complete with housing, school, hospital and varied recreational facilities.

In 1973, Atlas geologists discovered the Carmen orebody. Work began on the Carmen project in June 1976 and production commenced 17 months later. The combined throughput of the then three concentrators reached 110,000 MTPD at their peak, some 30 times the original volume when Atlas began operations in 1955.

In the mid-80s, Atlas production began to taper off due to falling copper price and operational downsizing. By July 1985, the Biga concentrator suspended its operations, followed later by the DAS concentrator on December of the same year. By September 1986 Biga concentrator resumed its operation until March 1992. On August 16, 1994, all Atlas operations were suspended indefinitely after a major "mudrush" in the Carmen underground halted its production life.
In September 16, 2004, Carmen Copper Corporation ("Carmen Copper") was incorporated as a subsidiary company of Atlas Mining to operate the Toledo Copper Mine located at Barangay Don Andres Soriano, Toledo City.

Atlas Mining concluded a funding transaction with Crescent Asian Special Opportunities Portfolio (CASOP), a Singapore-based equity partner, to finance the Toledo Copper Mine rehabilitation and reopening. This development set into motion the clock to re-start the road to rehabilitation.

Full-scale rehabilitation of the Toledo Copper Mine commenced in September 2007. A year after, production resumed with a start-up milling rate of 20,000 metric tons of copper ore per day and gradually increase its production to 40,000 metric tons per day.

Currently, the company's ore production is 48,000 metric tons per day with equivalent concentrate production of 42,000 metric tons per day. Details of the production are separately discussed in 2.1.5 and 2.1.6, respectively.

Milestone

- 1932 - IXL Mining Co. of the DAS group was organized to develop 33 lode claims in Balete, Masbate

- August 1932 - DAS-owned Antamok Goldfields Mining Co. was incorporated. It mined 35 full& fractional claims, with an area of 231 ha, in Itogon, Mountain Province. Its initial daily capacity of 150 tons in 1933 grew to 400 tons in 1934, & 750 tons in
- 1935 - Masbate Consolidated Mining Co. of the DAS group was organized to take over the Panique Mines in Masbate. Its daily mill capacity grew from 200 tons to 2,000 tons.
- 1953 - Incorporated as Atlas Consolidated Mining and Development Corporation under the aegis of Andres Soriano y Roxas
- 1978 - Attained a milling capacity of 110,000 dry metric tons (DMT) per day from 3 concentrators – Dascon, Bigacon & Carcon, then the biggest in the Far East
- 1994 - ACMDC operations were suspended indefinitely due to depressed metal prices
- 2004 - Carmen Copper Corporation incorporated on September 16, 2004 - a subsidiary of ACMDC
- 2007 - Started full scale rehabilitation of the Toledo Copper mine
- 2008 - Production resumed at Carmen Concentrator with a milling rate of 20,000MT of copper ore per day.
- 2011 - SM Investments Corporation (SMIC), one of the country's largest and most respected conglomerates becomes a major shareholder
- 2017 - On November 23, Carmen Copper marked its 250th shipment of copper concentrate

Awards

- Presidential Mineral Industry and Environment Award (PMIEA) Titanium Achievement (2017)
- Presidential Mineral Industry and Environment Award (PMIEA) Platinum Achievement (2018, 2019)
- PMSEA | Most Improved Safety Performance (2019)

Gawad Tugas

- Gawad Tugas for Forest Protection and Management (2017)
- Gawad Tugas for Responsible Mining (2015, 2018)

Best Mining Forest

- Best Mining Forest Champion (2010)
- Best Mining Forest 1st Runner Up (2011)
- Best Mining Forest 2nd Runner Up (2012)
- Best Mining Forest 1st Runner Up (2013)
- Best Mining Forest, 2nd Runner Up (2014)
- Best Mining Forest 1st Runner Up (2015)
- Best Mining Forest 2nd Runner Up (2016)

Other Awards

- Best National Greening Program Implementer in Region 7 (2013)
- Outstanding Grievance Machinery for Industrial Peace (2017, 2019)
- Silver Anvil Award for 2017 Sustainability Report
- Silver Anvil Award for 2018 Sustainability Report

1.1.3 Process Documentation

The terms of reference for the conduct of this Environmental Impact Assessment (EIA) and preparation ot this Toledo Copper Mines Environmental Performance Report and Management Plan is consistent with that stipulated in the Revised Procedural Manual (RPM) for Department of Environment and Natural Resources (DENR) Administrative Order (DAO) No. 2003-30, Implementing Rules and Regulations of Presidential Decree No. 1586 "Establishing the Philippine Environmental Impact Statement System

1.1.3.1 **The EIA Team**

The composition of the EIA Team comprises of specialists that comes from the project EIA consultants and technical personnel from the Carmen Copper Corporation who have taken part and provided inputs to the EIA study/EPRMP reports

Andres Muego	C.E., EnP, MSUEM, Environmental & Land Use Planner, Certified BERDE (Green Building) Professional	EIA Process, Land Use, Settlements, Environmental Management
Aiza Cortes	Energy-Environmental Engineering, Biology	Air pollution/GHG Emissions
Dennis Francisco	Geologist	Geology, Geo-hazard assessment
Carlo Alburo	Chemical Engineer	Pollution, water treatment
Boots Henry Tamala	Metallurgist	
Ferdinand Paculanang	Mining Engineer	Mining Operations
Hemres Alburo		Biodiversity Study

1.1.3.2 **The EIA Methodology and Study Schedule**

The primary reference and guide in the undertaking of this TCM /Mine-to-Port Operations EIA study are the Revised DAO 03-30 procedural Manual of the DENR-EMB, latest guidelines issued by the EMB, and the EIARC Technical Scoping checklist/results of technical scoping meeting-that serves as the Terms-of-Reference (TOR) for the conduct of the EIA study and preparation of the EPRMP reports.

The study's activities followed the general procedure of data collection, analysis, impact identification and formulation of the environmental management plan. However, as an EPRMP study, the existing operations, environmental management and compliance to the ECC conditions issued to the various facilities (e.g. Biga TSF and WRDs) of the TCM-minesite were assessed and form part of this report.

With the issuance of the DENR Administrative Order No. 2017-15 (dated May 02, 2017) "Guidelines on Public Participation under the Philippine Environmental Impact Statement (EIS) System" the public involvement in the 'scoping, review and approval process is strengthened/enhanced through the mandatory requirement of undertaking the IEC, public scoping/consultation and public hearing

Baseline data was sourced-out from both secondary and primary sources. Secondary sources were primarily culled-out from documents and references, such as the various EIA studies conducted for ACMDC/CCC, Atlas Environmental Baseline Study, Maunsell and GHD Studies, Biodiversity study, EPEP; and others; while primary data were the results of actual site assessment and interview/discussion with the project proponent.

Table 1.1 **EIA-EPRMP Study Schedule of Activities**

Activities	***Date Undertaken***
A. ***PRELIMINARY EIA ACTIVITIES****. project conceptualization, architectural design, Engineering details, etc.*	
B. ***PREPARATION AND SUBMISSION OF ECC APPLICATION & EIS REPORTS***	
1. IEC/Public Consultation for Airstrip Site WRD Amendment	*Oct. 28, 2019*
2. IEC/Public Consultation for Carcon Facility	*Feb. 24, 2020*
3. Submission of PDR and request for Scoping for Carcon Facility	*August 20, 2020*
4. Technical Scoping meeting for Carcon Facility ECC application	*Sept. 6, 2020*
5. IEC Focus Group Discussions for the Integrated/Mine-to-Port Operations	*March 6-25, 2021*
6. Conduct of Public Scoping for the Eight Barangays	*July 6-22 2021*

7. Submission of PDR for /Mine to Port Operations ECC application	
8. Conduct of Technical Scoping	*October 22, 2021*
9. Preparation/Submission of EIS-EPRMP 1st Draft Report	
10. Conduct of Technical Review by the EIARC	
11. Preparation/Submission of Compliance to Results of Review/Modification of EPRMP Report	
C. ISSUANCE OF ECC DECISION	

1.1.3.3 **Public Participation**

A number of IEC/public consultations were conducted prior to the formal public scoping for the Carmen Copper Corporation's Toledo Copper Mines Mining and Processing. Prior to this plan submission of ECC application for the TCM Mining and Processing operations, IEC/Public Consultations were also conducted for the supposedly ECC Amendment for the Airstrip WRD and the ECC for the Carmen Concentrator Facility, which was shelved/cancelled as it was advised/recommended to integrate all the ECCs issued and the entire mining and processing operations of the Toledo Copper Mines. These pre-public scoping IEC/Consultations were proponent-driven and without the presence/attendance of EMB CO or EMB7 representative.

The formal public scoping with the presence/participation of the EMB-CO was conducted for each of the Barangays considered as within the primary impact or within the immediate vicinity of the Toledo Copper Mines.

1.1.3.3.1 Public Scoping for the TCM/Mine-to-Port Operations ECC application

Hosted/attended by the EMB-Central Office, the public scoping were conducted separately for each of the Barangays, with the following schedule, typical programme, and the issues/concerns raised by the stakeholders/participants and responses from the CCC/Project Proponent:

Table 1.2 Schedule of Public Scoping

	Barangay	Date	Time	Venue
1	Bagacay	July 6, 2021	8:30-12:00	CCC Social Hall
2	Loay	July 8, 2021	8:30-12:00	CCC Social Hall
3	Daanlungsod	July 9, 2021	8:30-12:00	CCC Social Hall
4	Poog	July 13, 2021	8:30-12:00	CCC Social Hall
5	Don Andres Soriano (DAS)	July 15, 2021	8:30-12:00	CCC Social Hall
6	Media Once	July 16, 2021	8:30-12:00	CCC Social Hall
7	Cantabaco	July 20, 2021	8:30-12:00	CCC Social Hall
8	Biga	July 22, 2021	8:30-12:00	CCC Social Hall

Table 1.3 Typical Public Scoping Programme

PROGRAMME		
PART 1	REGISTRATION AND PERCEPTION SURVEY	
8:30-9:30a.m.	Registration of Participants and Handing out of Perception Survey Forms Collection of completed/answered survey forms	CCC Secretariat

PART 2	FGD/PUBLIC SCOPING PROPER	
9:30-10:00	Opening Prayer and Playing of National Anthem	Secretariat CCC Representative Brgy. Captain Moderator
	Welcome Remarks & Introduction of Participants	
	Programme Mechanics/Expectations	
	Brief Introduction of the Phil. Environmental Impact Statement System (PEISS)	EMB-Central Office EMB7
10:00-10:30	Project Presentation Proper	CCC Rep
10:30-11:30	Open Forum and Discussions	Moderator
11:30-11:45	Summary of Discussions	CCC Rep
	Closing Remarks and Way Forward	EMB-Central Office
11:45-12:00	Collection of completed Perception Survey forms	

1. Public Scoping for Barangay Bagacay (July 6, 2021 at CCC Social hall)

Table 1.4. Issues/Concerns Raised by Participants in the Brgy. Bagacay Public Scoping

Stakeholder	Issues & Concerns	CCC Response
Hon. Ramo Ragodos - Brgy Chairman	- Follow up the status of requested footbridge project intended for the Bagakay Elementary School.	- Mr. Pritos of Community Relations (ComRel), Final design/plan of the said project will be completed this week.
Mrs. Lucia Racoma - BFA President	- Grateful to the company for the privilege given to them as one of the SDMP project recipient.	- The company acknowledged and also grateful for the continuous support from stakeholder/PO's.
Ms. Janel D. Alfar - Teacher, Bagakay Elem. School	- Grateful to the company in providing various projects given to the school.	- The company acknowledged and also grateful for the continuous support from stakeholder/PO's.
Hon. Ramon Ragodos - Brgy Chairman	- Requested heavy equipment from the company for their site preparation of the barangay project.	- Mr. Pritos of ComRel, their office includes, Mining Tenement and General Services group will visit the site to evaluate the area on what will be the appropriate equipment to be used.

Figure 1.1 Photos taken during the Bagacay Public Scoping

2. Barangay Loay (July 8, 2021 at CCC Social Hall)

Table 1.5. Issues/Concerns Raised by Participants in the Brgy. Loay Public Scoping

Stakeholder	Issues & Concerns	CCC Response
Mr. Rey Jose A. Elladora - Brgy. Council	- Inquired on how much is the percent of share from the SDMP budget allocated for Brgy Loay?	- Mr. Pritos of ComRel, based on the law there is no clear direction as to how many percent allocated of the host barangay. It will depend on the result of the annual consultation meeting and the identification of their priority projects.
Mrs. Daisy Lariosa - Brgy. Secretary	- Clarification on Birthing facility project which was already completed, Mrs Lariosa was asking on what happened to the requested equipment that were include on the project. - Raised the concerns regarding the employment of barangay residents - Asked the guidance from ComRel on how to use the generated income from their previous project Community-Based Reforestation.	- Mr. Pritos of ComRel, there was a delay on the procurement of equipment due to Covid19 outbreak. - The request for the needed equipment already at the purchasing group for canvassing and procurement. - Mr. Pritos of ComRel, the company is on the process on conducting skills inventory in all host barangays. - Mr. Pritos of ComRel, the cooperative should think other livelihood programs and prepare a project proposal. Then once the project approve by the PO with the guidance of the SDMP coordinator they can used the coop fund available.

Mr. Manuel Bahina - Principal, Loay Elem. School	- Requested the assistance of the company regarding community safety concerns brought by landslide prone portion of the access road.	- Mr. Pritos of ComRel, this will be included on during the SDMP annual Planning session (September).
Mrs. Marcelina Jacobe - ACFa Member	- Grateful to the company for the privilege given to his husband and children as one of the scholar of Technical Skills program. They are now been working in the big company using their new acquired skills.	- The company acknowledged and also grateful for the continuous support from stakeholder/PO's.
Ms. Ana Sharmin B. Sagabal - DENR-ENRO Toledo City	- Verification of land ownership and claims.	- Mr. Salcedo of Environment, they can visit company for their queries.

Figure 1.1b Photos taken during the Brgy. Loay Public Scoping

3. Barangay: Daanlungsod (July 9, 2021 at CCC Social Hall)

Table 1.6. Issues/Concerns Raised by Participants in the Brgy. Daanlungsod Public Scoping

Stakeholder	Issues & Concerns	CCC Response
Hon. Jose D. Letrago - Brgy. Council	- Concerning possible discharges from the Port facility that might be harmful to the community.- Asking for the status of their barangay resolution requesting the company to include Brgy. Daanlungsod as one of the host barangay. - Grateful to the company in providing a scholarship program not only for those students that has a high grades but also for those that has average or low grades that has determination to finish school. - Clarification if the scholarship grant were equally given to all barangays. - Asking if what are the priority projects the company can provide to the barangay.	- Mr. Salcedo of Environment, all solid wastes generated at the port were collected by Toledo City. The port were provided with Comfort rooms with Septic tank. - Mr. Pritos of ComRel, the request was already forwarded to MGB 7 office. MGB7 to evaluate and approve if the barangay be considered as additional host barangay considering that the port is under their jurisdiction. - The company acknowledged and also grateful for the continuous support from stakeholder/PO's. - Mr. Pritos of ComRel, there is a consideration that priority of the scholars will be in the host and neighboring barangays. - Mr. Pritos of ComRel, as of the moment and while waiting from MGB7 evaluation and approval to consider the barangay as "host barangay" there were already engagement between the company and the barangay.
Hon. Rogelio Maybuena - Brgy. Chairman	- What precautionary measures implemented by the company in every cargo ship docking at the port to ensure the safety of personnel and community as a whole against Covid19. - Livelihood (sugbusog), projects and programs that can be implemented in the barangay. - Measures in handling and disposal of waste from the cargo ship, air and water pollution.	- Mr. Salcedo of Environment, the company has existing control and strictly imposed the safety and health protocol set by the government particularly Phil. Coast Guard. This also includes the crew has limited access to the port with complete PPE's during transactions. - Mr. Pritos of ComRel, regarding the "Sugbusog" program, the company is in the final stage of validation and review regarding the request to utilize the Atlas property for use as nursery rearing for community vegetable production. - Mr. Salcedo of Environment, all international vessels is governed under the Maritime Pollution (MarPol) by the Phil. Coast Guard to ensure compliance of the vessels.
Mr. Luisiano Cabaguiran - DENR-ENRO Toledo City	- Ask the company to provide a shapefile of the company's reforestation map	- Mr. Sabijon of Environment, the company will provide the document to DENR.

Figure 11.c Photos taken during the Brgy. Daanlungsod Public Scoping

4. Barangay <u>Poog</u> (Date: July 13, 202, CCC Social Hall)

Table 1.7. Issues/Concerns Raised by Participants in the Brgy. Poog Public Scoping

Stakeholder	Issues & Concerns	CCC Response
Mr. Artemio Comeros - Sr. Citizen	- Dust emitted by the Dump Trucks passing the highway road of the barangay that can be minimized or eliminated. - Request the company to provide regular water truck in wetting the access road.	- Ms Batingal of Environment, the company regularly dispatches water trucks to spray water on the access roads to minimize fugitive dust and will also call the attention of the contractor regarding this concern. As agreed by the contractor (Petrostec) they have a regular wetting of access road. - For. Sabijon of Environment, aside from the company assigned water truck, the contractor will be reminded on their responsibility especially on the dust emission concern.

Ho. Clariza Alferez – Brgy. Chairman	- Ask the status of the projects requested by the barangay under the 5-Year SDMP Plan. - Proposed demolition and construction of new Multipurpose building or Daycare Center. - Status of request for Tractor equipment for the farmers of Brgy. Poog.	- Mr. Geriane of ComRel, to check project status marked as under management approval and will provide update to the school. - Mr. Geriane of ComRel, it's the barangay to decide of which project will be push through (Multipurpose building or Daycare Center). CCC is waiting for the official request from the barangay regarding the multi-purpose project. - Mrs Patatag of ComRel, the company already contacted the supplier to provide a formal quotation to be used as reference for the procurement request.
Mr. Ricardo H. Lubino - Sr. Citizen	- The contractor (Petrostec) should put a regular/permanent water truck in wetting the access road to eliminate dust.	- Ms Batingal of Environment, the contractor were reminded on their duties and responsibilities specifically on the dust emission concern.
Mrs. Paterna Lazaga - Principal, Poog Elementary School	- Grateful to the company in providing assistance to the school such feeding program, Brigada Eskwela activity, materials and supplies, etc. - Inquiring the status of pending request for perimeter fence intended for the school.	- The company acknowledged and also grateful for the continuous support from stakeholder/PO's. - Mrs. Patatag of ComRel, to check the status of pending project and provide update to the school.
Mr. MC Monsales - President, Sr. Citizen	- Unsafe old structure/building of the Senior Citizen office.	- Mr. Geriane of ComRel, will visit the area to assist the request.
Engr. Dexter Tabada - EMB Central Office	- Ask if the famous cliff/rock wall climbing area at Cantabaco is affected by the operation of the company?	- Mr. Sabijon of Environment, The said area is far from the mining operation of the company.

Figure 1.1c Photos taken during the Public Scoping -Brgy Poog

5. Barangay: Don Andres Soriano (DAS) (July 15, 2021, CCC Social Hall)

Table 1.8. Issues/Concerns Raised by Participants in the Brgy. DAS Public Scoping

Stakeholder	Issues & Concerns	CCC Response
Mr. Pedrito Basadre - Sr. Citizen	- Asking why the company is applying for another ECC even though it was already operating. Clarification on specific location of mining activities. - Concern on possible effect on water source from Brgy. Cantabaco due to the mining activity at Lutopan Pit.	- For. Sabijon of Environment, the company has acquired a Certificate of Non-Coverage for and three (3) Environmental Compliance Certificates (ECC's) and has two (2) application for ECC amendment at EMB. But during the evaluation, the EMB Central Office recommended to integrate or consolidate the existing CNC & ECC's and pending applications into one ECC for easy monitoring and compliance. - Geologist A Abanto, current mining activities are still at Carmen Pit as ore source and portion of Lutopan Pit as waste dump area. No Stripping activity at Lutopan Pit as of the moment. - There was no longer activity at Lusong area. In fact, the Lusong Waste Rock Dump area were already vegetated.
Hon. Redentor Cabrera - Brgy. Council	- Asking the proposed annual mining program presented in color coded. - How far from the community is the mining activity?	- Engr. Paredes of MOP, The proposed long term mining program presented is only for presentation purposes on how mining activity being process and implemented. - Geologist A Abanto, the company will provide the appropriate data regarding the distance of mining activity to the community during public hearing.

Pastor Rolando - President, ACFALA	- asking the status pending SDMP project (Swine, Egg layering & Vegetable farming, etc.).	- Mr. Pritos of ComRel, the project already on-the-pipeline this year. There was a delay on the implementation due to the incident happen last December 2020.
Mrs. Ma. Donitha C. Hernando - President, De La Salle AMSC	- Grateful to the company for the assistance provided to the schools and to the community.- What are possible draw backs or adverse effect of the project?	- The company acknowledged and also grateful for the continuous support from stakeholder/PO's. - For. Sabijon of Environment, the company established an environmental monitoring group to ensure that all the mining activity is within the standard set by the regulatory agencies. Aside from in-house monitoring, there is an independent monitoring group which is the Multi-Partite Monitoring Team (MMT) the visit the mine site every quarter to conduct air and water quality sampling, plants & shops inspections to ensure company's compliance.

Figure 1.1d Photos taken during the Public Scoping - Brgy. DAS

6. Barangay Media Once (July 16, 2021, CCC Social Hall)

Table 1.9. Issues/Concerns Raised by Participants in the Brgy. Media Once Public Scoping

Stakeholder	Issues & Concerns	CCC Response
Hon. Hilario L. Alferez - Brgy. Chairman	- What is the equivalent amount of the 75% SDMP in the 1.5% of the operating cost for 2020. - Ask for transparency of the reports, projects, etc. allotted for the barangay. - Was the fire incident happen in the barangay were being charge under the SDMP fund? - Where is the reforestation area planted/developed by PBF Association? - Where the garbage was collected and disposed and what barangay was garbage collection serviced by the company? Asking for a new unit of Ambulance instead of repair the old unit.	- Mr. Pritos of ComRel, the equivalent amount of the 75% for SDMP is 109 Million for 2021. - Mr. Pritos of ComRel, this is well noted. - Mr. Pritos of ComRel, yes, all community assistance in response to fire, vehicular accidents and use of facilities were being charge to SDMP. - For. Sabijon of Environment, the planted area by PBFA was within Carmen Pit and Sigpit-Mabais Waste Rock Dump (WRD) area. - Ms. Batingal of Enviornment, the garbage collection and disposal was only within the company premises. - Mr. Pritos of ComRel, the company consulted a 3rd party service provider that provides a machinery equipment capable of converting the waste into recyclables and used products that can be used as livelihood, waiting for the feasibility study prepared by 3rd Party. - Mr. Pritos of ComRel, commit to give feedback first week of August whether to proceed on the repair or to buy new ambulance.
Mrs. Dahlia H. Villacensio - OIC, Media Once Elementary School	- Asking if they can avail the scholars program, and what are the requirements needed to qualify for scholarship program.	- Mr. Pritos of ComRel, the company already prepared a slot for scholarship allotted equally in every barangay. Also accepting and start consolidating scholarship applicants.
Hon. Jaime Abarquez - Brgy. Council	- My eldest child was a scholar in Senior High school and already completed. To avail the scholarship for college, is it still necessary to undergo with another screening process?	- Mr. Pritos of ComRel, the same process and requirements in applying and screening for college scholarship.

Mrs. Rocelle S. Sala - Principal, Pandong Bato Elementary School	- If the company has a preferred or accredited school for the scholars either in private schools or State Colleges? - Can a student choose any course he/she desires? - Can the company provide medical support for minor treatment to communities?	- Mr. Pritos of ComRel, the company encourage scholars to enroll in State Universities/Colleges to accommodate more qualified scholars instead of enrolling to private schools that requires high tuition every school year. However, it also put into consideration the courses offered or available only at private schools. - Mr. Pritos of ComRel, yes, as long as within the 5-year courses such as engineering, etc. - Mr. Pritos of ComRel, the company accept patient and will provide minor medical support needed by the communities especially those residents identified as indigent. This was already practice to some individual that were endorsed by the barangay.
Mrs. Lucia p. Tomarong - Brgy. Council	- Asking the status of request for the repair ambulance	- Mr. Pritos of ComRel, already with clearance from the management and subject for repair through out-sourcing.

Figure 1.1e Photos taken during the Once Public Scoping- Brgy. Media

7. Barangay: Cantabaco (July 20, 2021, CCC Social Hall)

Table1. 1.10 Issues/Concerns Raised by Participants in the Brgy. Cantabco Public Scoping

Stakeholder	Issues & Concerns	CCC Response
Mr. Andres Juarez - President, Sr. Citizen	- Concern in the event if the barangay hit by a tornado or typhoon and the possibility of the Ilag-Masaba Tunnel clogging that will eventually flooded the barangay Cantabaco way back in 1990's. What the company can do to prevent clogging of the tunnel? - 70-80% of the residents are dependent on the water source that may possibly affected by the mining operation.	- Mr. Ares of Environment, in the event of heavy rains or typhoons, representative from Environment, Construction and General Services will immediately check the situation of the tunnel and assist if there's a need to clear the tunnel from debris and waste that cause clogging. - Geologist A Abanto, already stopped the waste dumping of the Lusong WRD. This confirm also that no complained received by company from barangay residents.
Hon. Bernard Villarin - Brgy. Chairman	- Concern regarding the Masaba waste dump area hit by disaster, what assurance that the waste materials will not be eroded. In addition, can the contractor (Petrostec) operating the area to prioritize hauling the top portion of the waste dump?	- Geologist A Abanto, the design of slopes was 30 meters width of the catch berms so that no waste material falls into the community. Other details will be presented during the public hearing to ensure that the data presented is precise and accurate. - It was confirmed that the contractor is operating on the top portion of waste dump. - Portion of Lutopan-Masaba waste dump already planted with tree seedlings.
Ms. Ana Sharmin B. Sagabal - DENR-ENRO Toledo City	- Ask if the company is well-prepared and has the ability to avoid any recurrence of untoward incident like what happened last December 21, 2021.	- Geologist A Abanto, yes, part of the company initiatives, are enhancement and procurement of advance technology capable in monitoring ground movements and slides within the pit.
Ms Joy A. Lubino - Teacher, Apid Elem. School	- Grateful to the company in providing assistance to the schools and to the community. - Ask the assistance of company to look into the drainage system at the upper portion Mt Carmel Cemetery were her parents are volunteers. During heavy rains some of the waste materials will be carried by water going to the Cemetery Chapel. This was due unmaintained drainage within the area.	- The company acknowledged and also grateful for the continuous support from stakeholder/PO's. - For. Sabijon of Environment, the company will send personnel to assist and evaluate the area to address the concern.
Mrs. Janet D. Sabellano - Teacher, Cantabaco Elem. School	- Clarification on the cracks at the mining operation that circulates in the social media.	- Geologist A Abanto, the reported cracks at the Cantabaco are natural effect and not related to mining activity. Limestone in nature is fragile and eroded by rain water due to the slight acidic nature of rain. Also, the distance of the operation to the crack area is quiet significant. .

Figure 1.1f Photos taken during the Public Scoping - Brgy. Cantabaco

8. Barangay Biga (July 22, 2021, CCC Social Hall)

Table 1.11. Issues/Concerns Raised by Participants in the Brgy. Biga Public Scoping

Stakeholder	Issues & Concerns	CCC Response
Mrs. Elizabeth Consad - Principal, Biga Elementary	- Follow up request for repair of school classrooms. - Company's plan on the turn-over of the newly constructed high school building.	- Mrs. Espina of ComRel, well noted, will give feedback the status of request which was received on the 2nd week of June 2021. - Mr. Bacalso of ComRel, advised the school representative to prepare a request letter regarding the turn-over of new school building.
Mrs. Imee C. Papillero - Principal, Makatol Elem. School	The Mrs. Papillero (newly assigned principal) was asking the requirements needed if the school will ask for assistance?	- Mrs Espina of ComRel, there is a pending issues regarding the future utilization of company property wherein the school occupied.
Hon. Eliseo Dejardes - OIC-Brgy. Chairman	- Follow up the status of the barangay resolution requesting the company to provide access road right of way going national road. - Asking to continue the health services provided by the company which is the "Doctors to the Barangay" project.	- Mr. Bacalso of ComRel, will inquire to Land and Mining Tenement (LMT) and will provide feedback to the barangay regarding the status of their request. - Mrs Espina of ComRel, due to Covd19 pandemic the "Doctors to the Barangay" project were temporarily stop but rest assured when time comes that the safety of all will not be compromised the program will to continue, so as other company activity such as feeding programs, etc..
Mrs. Beatriz Labandero - Sr. Citizen	- Both of them are senior citizen already, she then ask /request if the company can hire his son who was a scholar of the company in Technical Vocational Course and already completed his training.	- Mrs. Espina of ComRel, the TechVoc training is to enhance the capability of individual to find job not only within the company but also other companies or even abroad. - Mr. Ares of Environment, the company is planning to conduct a skills inventory in all host barangays.
Mr. Noel Cavan - DENR-ENRO Toledo City	- Concern regarding the nursery station at Malubog area regarding the reported water used for watering the seedlings is acidic that caused there seedlings dead, as alleged.	- For. Sabijon of Environment, as of May 20, 2021 the water pH of Guinguiyotan river is 7, that's basic. The company already conducted inspection and report was already submitted..

Figure 1.1g Photos taken during the Public Scoping - Brgy. Biga

1.1.3.2 IEC, Public Consultation for the TCM Mining and Processing Operations

Format/ Outline of the IEC, Public Consultations Programme for the TCM Mining and Processing Operations EIA Study/ECC application:

- PEISS regulations for the ECC application of the Company, the need to conduct IEC, public consultations and perception survey for the surrounding/affected communities
- Company (CCC) existing ECCs and the need to integrate and apply for an ECC for the whole mining operations
- Brief discussion/overview of the entire mining operations, vision/objectives of the Company,
- Open Forum

Table 1.12 IEC/Public Consultations Summary of Concerns

	Barangay Date/Time/Venue	No. of Attendees/ Residents	Summary of Concerns/Insights Raised
1	Barangay Bagacay March 6, 2021/2:05PM Bio Char Bldg., Purok 4	16	a) Mr. Virgilio Rico (Bagakay Farmers Asso) indicated that they don't have any concerns since they understood very well the mining operations b) Mrs. Lucia Racoma (BFA President), on behalf of her co-participants, expresses their gratitude to the company for the continuing support (CCC has supported-assisted BFA in some of their programs/projects)

2	Barangay Cantabaco March 24, 2021/10:00-11:30AM Tech Voc Bldg.	11	a) Ms Teriote expressd her gratitude on behalf of the ICAHBWA members for CCC assistance to the organization esp. the greening programs & seedling production projects *b)* Ms. Gaviola asked about the Biga landslide & latest updates - *CCC responded/provided the updates and developments.* c) Ms. Heruela asked about the waste rock dmping at the Cantabaco landfill and how the activity will affect the residents. – The CCC response were as follows: - Activity will be limited to company-owned lots and will not encroach on private lots - The engineered dumping of waste rocks will also help stabilize the area behind the cemetery and the areas surrounding the abandoned landfill.
3	Brgy. Daanlungsod March 26, 2021/11:10-12:10NN Brgy. Session Hall	13	a) Mr. Masicampo (former ACMDC employee) indicated that they don't' have any questions/concerns since they understood the mining operations b) Brgy. Capt. Maybuena expresses their intension that the barangay is one of the recipient/beneficiary of the SDMP, and that the barangay council has sent letter for that purposeMr. Salcedo of CCC told the group to create appointment/meeting of the concerned department esp with the COMREL
4	Barangay Don Andres Soriano (DAS) March 23, 2021/1:20-2:50PM Tech Voc Bldg.	12	• Mr. Canoneo inquiry on exploration area & corresponding limits • Mr. Salas asked about the location of the latest landslide and updated on retrieval opertions • Ms Salas request for educational mine tour/museum visit • Mr Salas inquired on the destination of Copper Concentrates product- *CCC response: China, Japan, Korea and local (PASAR). Used for electronic parts like Cellphones.* • Ms Cabiluna asked about the lifespan of the present mine. • Ms Salas on the Ongoing Scholarship programs • Mr. Salas on Impacts of tailings to the environment • Mr Villarmina statement on Lake Bensis and its operations as example of tailings pond capable of sustaining life-but the activities of tourists, visitors and their irresponsible behaviors such as garbages littering are destroying its flora and fauna • Ms. Paran on covering of open pits when mined-out.
5	Barangay Loay March 25, 2021/10:25-11:35AM Barangay Health Center	9	• Mr. Bonhanoy of Sta. Cruz Farmers Asso (SCFA) indicated that they don't' have any questions/concerns regarding the discussion since they understood very well the mining operations • Mrs. Jimenez of Lupon Tagapayapa of the barangay, indicated that they don't' have any questions/concerns regarding the discussion since they understood very well the mining operations -mentioning the construction of the covered court, Barangay Health Center, and ambulance.
6	Barangay Media Once Pandongbato March 23, 2021/10:00-11:00Am	10	• Mrs Basalo indicated that they don't have any questions/concerns regarding the discussion since they understood very well the mining operations • Mrs. Obcial indicated that on behalf of her co-participants, she would like to express their gratitude to the company for the support given to them
7	Barangay Poog Sitio Camalig March 25, 2021/ 10:30-11:40 PM		• Mr. Rabanes that they don't have any questions/concerns regarding the discussion since they understood very well the mining operations • Mrs. Mancao indicated that on behalf of her co-participants, she would like to express their gratitude to the company for the support given to them

Figure 1.2. Photographs taken during IEC/Public Consultations in various Barangays (within Project Affected Areas)

Figure 1.2a Photos taken during the **Brgy. Bagakay** IEC, Public Consultations & Perception Survey

Figure 1.2b Photos taken during the **Brgy. Cantabaco** Residents IEC, Public Consultations & Perception Survey

Figure 1.2c Photos taken during the **Brgy. Daanlungsod Barangay Officials** IEC/Public Consultations

Figure 1.2d Photos taken during the Brgy. DAS residents IEC/Public Consultations & Perception Survey

Figure 1.2e Photos taken during the **Brgy. Loay** residents IEC/Public Consultations & Perception Survey

Figure 1.2f Photos taken during the **Brgy. Media Once** residents IEC/Public Consultations & Perception Survey

Figure 1.2g Photos taken during the **Brgy. POOG** residents IEC/Public Consultations & Perception Survey

1.1.3.3.3 IEC/Public Consultation for the Carmen Concentrator (Carcon) Facility

The Public Scoping/Consultation was conducted last February 24, 2020 (10:00-12:00am) at the Brgy. Biga Bagong Buhay Hall, attended by 43 residents and PO members.

The highlights/minutes of meeting were as follows:

- The meeting started with a short introduction of the company representatives by Mr. Bacalso.
- After the short introduction, Mr. Salcedo, proceed to present a brief background of the operation of the company, starting with the acquisition of the Certificate of Non-Coverage (CNC), the start of the rehabilitation of all mine related facilities and the operation of the plant by late 2008 and continuous operation of the mining complex until the present.
- Mr. Salcedo then proceeded to discuss the plan of the company to acquire an Environmental Compliance Certificate (ECC) for the Carmen Concentrator Facility.
- Mr. Salcedo reiterated that the Carmen Concentrator Facility is already covered by the issued CNC, and proposed ECC application is intended to further assure compliance of the facility to other regulations from concerned government agencies.
- After the short presentation of the project, the floor was open for questions and clarifications. Mr. Joemar Pritos was the appointed moderator.
- Question 1: Mrs. Marites Bolo, a resident of So. Danawan, Biga, Toledo City asked if the proposed application will affect the operation of Carmen Copper Corporation.

  Mr. Salcedo answered that the application will not in any way affect the operation of the company since the application will only involve documentary compliance. The operation of the Carmen Concentrator facility is already covered by the CNC issued.

- Question 2: Mrs. Edna Macaday, a resident of So. Hag-it, Biga Toledo City asked the group if there be major construction or earth moving activities involved in the project?

  Mr. Salcedo answered that the project will not involve any major construction or earth moving activities. The Carmen Concentrator facility is already existing and operational. there might be scheduled maintenance or repair activities for the facility, but that is part of facility maintenance.

- With no more questions from the group, Mr. Joemar Pritos proceed with the closing discussions. The meeting ended at about 11:15 am

Figure 1.2h Photos taken during the Public Scoping/Consultation for CarCon Facility

1.1.3.3.4 Airstrip Site WRD Facility ECC Amendment. The Public Scoping activity was conducted last October 28, 2019 (9:00-11:00am), at the San Isidro Chapel, Sitio Tipolo, Brgy. Media Once, Toledo City, which was attended by seventy-two local residents and Barangay Officials. A number of issues/concerns has been raised by the residents, a summary of which were the following:

1. Prioritization of employment opportunity generated by the project.
2. Previous commitment of CCC particular water sources improvement will be implemented prior to propose commencement.
3. Proper installation of Dust suppression equipment provided and
4. Access of local residents

Figure 1.21.i Photos taken during the Public Consultation for the Airstrip WRD Modifications/ECC Amendment

1.2 Project Description

1.2.1 Project Location & Accessibility

The Toledo Copper Mines is located in the City of Toledo, Province of Cebu. Toledo lies on Tanon Strait across from Negros Island and the city of San Carlos, Negros Occidental, located at the western coast of Cebu Province . Toledo is connected to Cebu City, the provincial capital and second largest Philippine metropolitan area, by two stretches of road crossing the rugged spine of the island: the Naga-Uling Road and the alternate Manipis Road.

Geographically, the Toledo Copper mine site is located between 123°42' longitude and 10°18' latitude, within the political jurisdiction of Toledo City in the island province of Cebu. Cebu Island is a long narrow land mass extending more than 200 km from north tosouth but just 40 km east to west at its widest point. The mine site is at the western slope of the central highland roughly in between the island's east and west coastlines. It is about 15 km from Toledo City and about 60 km from Cebu City

The TCM mine-to-port operations are within the properties of the Atlas Mines/ACMDC, MPSAs and APSAs located within the following barangays: Don Andres Soriano/Lutopan, Biga, Media Once, Loay, Daanlungsod, Poog, Cantabaco, Bagacay and Gen. Climaco-Toledo City

.

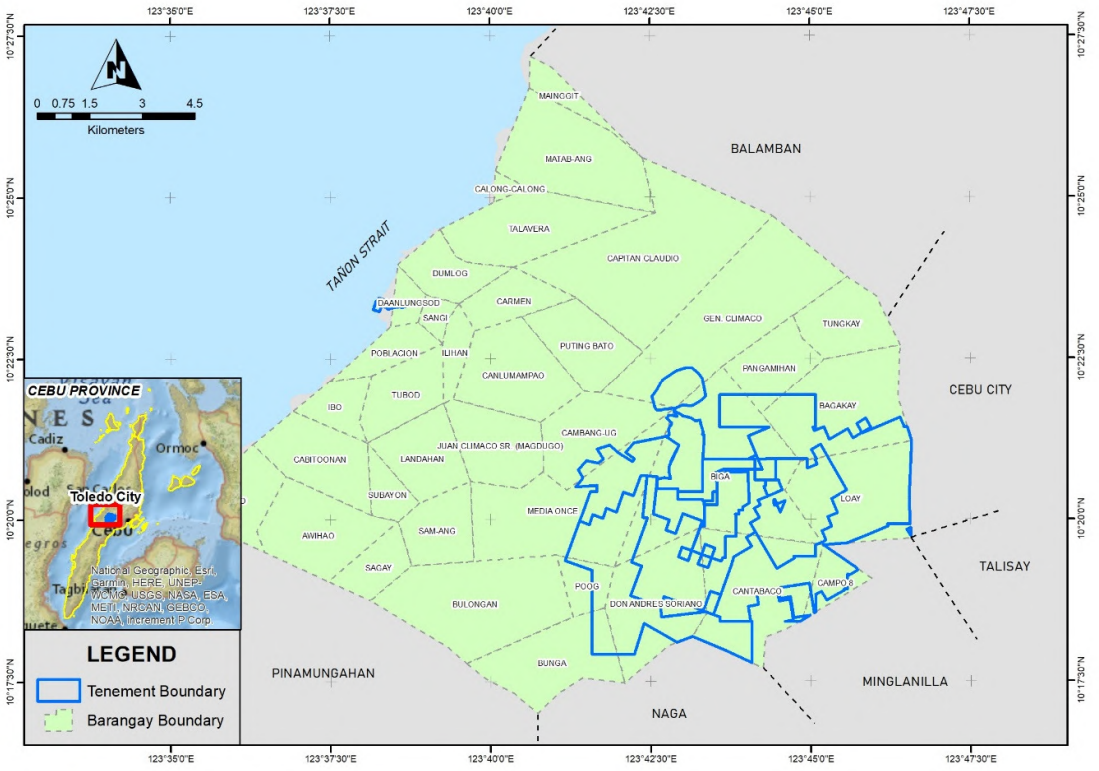


Figure 1.3. Location Map

Transporation Accessiblity

Road. From Cebu City (point of origin) to the minesite, there are two routes that could be taken. The Naga-Uling-Toledo Road (preferred) is a 42-kilometers all-weather concreted highway, which will take approximately an hour via private or public transport and cargo trucks. The Tabunok-Manipis Road (alternative) is the more shorter route with 34 kilometer distance. The preferred route, although takes longer (given also the heavy traffic in Minglanilla and Naga) is the more safer route that could also accommodate and convenient for large cargo trucks, as the latter has portions that are curves, narrow and with steep slopes more prone/susceptible to landscape specially during heavy rains and inclement weather. A third (alternative) route is through the Trans-Central Highway passing through the Municpality of Balamban, which is more or less 65 kilometers.

Sea/Shipping. From North Harbor, Manila, the site can be reached by commercial ship in about 21 hours to Cebu City (docking either at the Cebu International Port and the Cebu Domestic Port), thence by land trip passing either the Naga-Uling-Toledo Highway or the Tabunok-Manipis-Toledo National Road up to the CCC main gate at Barangay Don Andres Soriano, Toledo City. Total time consumed from Manila to the site is 22 hours.

Large mine equipment are transported by roll on - roll off vessels from the Port of Cebu to the Company's Sangi Port. Likewise, copper concentrates are shipped to its international and local destinations from this port.

Air Transportation. Domestic and International flights will land in Mactan International Airstrip in Lapu-lapu City/Mactan Island. From the Airstrip, the minesite could be reached through landtrip passing though either the Naga-Uling-Toledo or the Tabunok-Manipis routes.

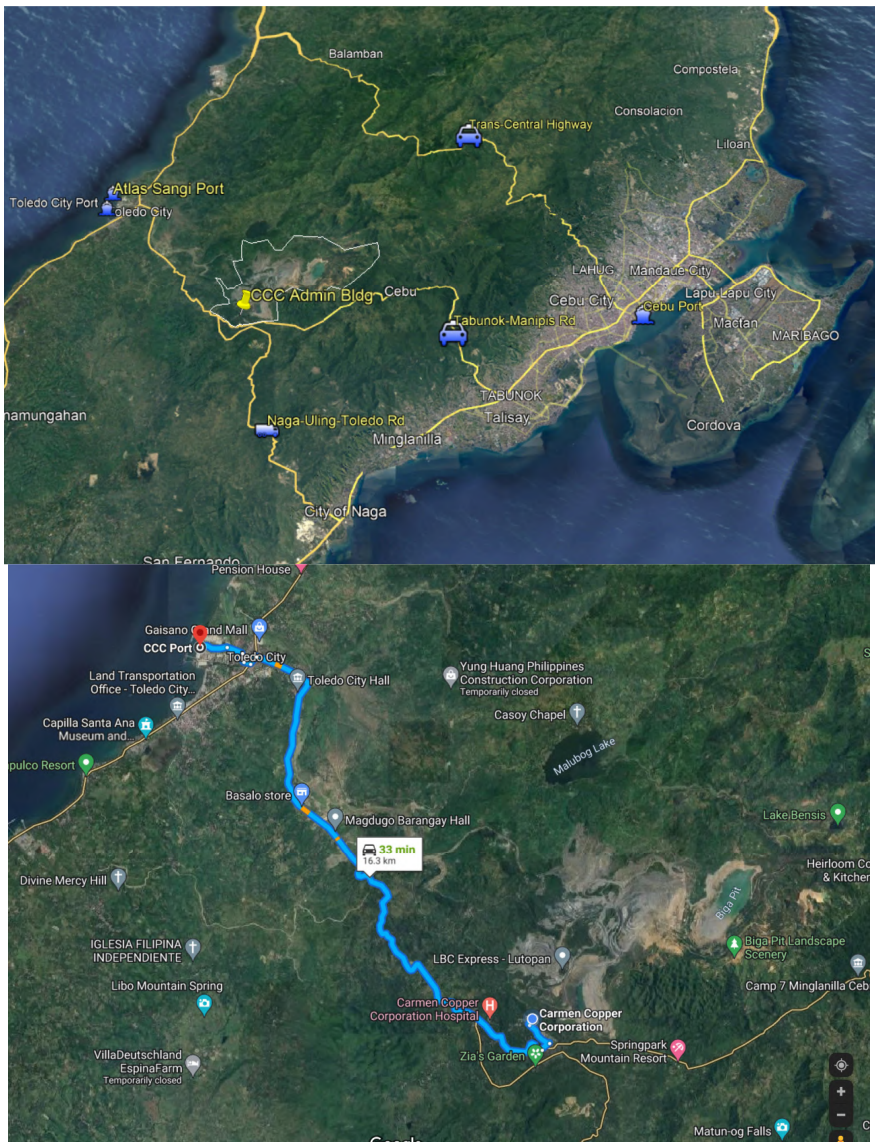


Figure 1.4 Transportation/accessibility Options from Cebu City to TCM Minesite (Above); Transportation Network Connecting the Toledo Copper Minesite and Port (Below)

1.2.2 Primary and Secondary Impact Areas

The study area covers both the direct (primary) and indirect impact areas of TCM Mine-to-Port Operations that included the existing facilities/operations and proposed modifications/additional facilities. Bases for delineation of the direct and indirect impact areas were the definition given by the Revised DAO 03-30 procedural manual, as follows:

> *"a) Direct impact area (DIA) is initially delimited during the Pre-EIA Study Stage as the area where ALL project facilities are proposed to be constructed/situated and where all operations are proposed to be undertaken . . . . For most projects, the DIA is equivalent to the total area applied for an ECC.*
>
> *b) Indirect Impact Area (IIA) during the pre-EIA Study can only be assumed or qualitatively estimated but may be guided by secondary data and information from key interviews of reliable*

local authorities, e.g. Based on a NAMRIA topographic map, an IIA can be the stretch of the river/s OUTSIDE the project area but draining the project site which can potentially transport sediments and other discharges from the project towards downstream communities.

c) On the other hand, the regional impact zone (RIZ) pertains more to the general area where the impact of the project would be felt, such as the entire municipality, province or region."

Given the above-reference, the Primary/Direct Impact Area (DIA) for Toledo Copper Mines are areas where mining facilities are located and operations undertaken, these comprises the 'minesite' and the pier/port area (enclosed in yellow in the figure below), covering a total land area of 4,849.239 hectares

The Indirect or Secondary Impact Area (IIA) covers the neighboring areas immediately outside of the primary impact area. The secondary impact areas has the potential to be affected by the TCM operation's noise, dusts, stormwater run-off and erosion, and other impacts - which includes downstream of creeks and rivers,where sediments/pollutants from the minesite may flow/deposited and roads that haulers/trucks traverses from the minesite to port and other points of destination.

The ECC applied area covers a larger area than the primary/direct impact area as this includes portions of the integrated MPSA/APSA and ACMDC properties not within the present minesite where mining operations are being undertaken.

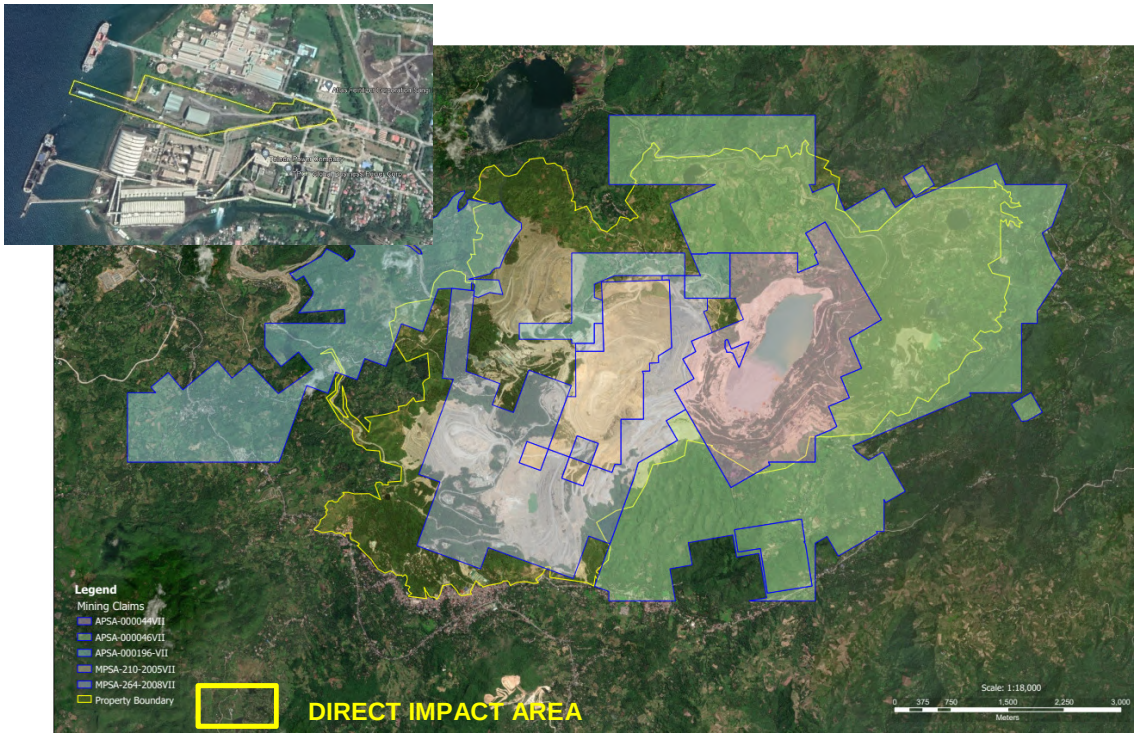


Figure 1.5 Primary and Secondary Impact Areas of Toledo Copper Mines

1.2.3 Land Area/Ownership

The FMRDP (2010) noted the following: "*The Toledo copper mine operations of Atlas Consolidated Mining and Development Corporation embraces a group of mineral claims that are covered by existing mining leases and applications for Mineral Production Sharing Agreement (MPSA). The claims are located in Barangays Don Andres Soriano, Biga, Cantabaco, Bunga, Media Once, and Cambang-ug, all in Toledo City, and Barangay Uling in Naga, Cebu. The mineral property spans a total area of*

5,218.1160 hectares, 3,284.4810 hectares of which are covered with mining claims owned by Atlas, while the remaining 1,933.6350 hectares covered with mineral claims belonging to other claimowners who have existing operating agreements with Atlas Geographically, the Toledo Copper mine site is located between 123°42' longitude and 10o18' latitude, within the political jurisdiction of Toledo City in the island province of Cebu.

Carmen Copper Corporation (a subsidiary of ACMDC) revived the Toledo copper mining operation and used a total area of 1,674.0479 hectares of the ACMDC property under CCC-ACMDC Operating Agreement Mining operations initially resumed at the Lutopan ore body (South Lutopan Pit) located inside MPSA No. 264-2008-VII. Total area covered by actual mine operations is 883.3034 hectares."

The mine site lies within an existing and previously developed area with facilities and infrastructures already in place. The major orebodies and, for that matter, the mining areas, strike in the northeast-southwest direction, with the Carmen orebody (and mine workings) situated at the center of that alignment. Barangay DAS and its commercial-residential center are situated on the southwest extension of the axis."

While the mineral property spans a total of 5,218.116 hectares, the CCC operates (mine-to-port operations) within an area of 4,849.239 hectares, which is a consolidation of the MPSAs, APSAs and ACMDC privately-owned properties. The 4,849.239 hectares covers the Toledo Copper Mines, which is the subject of this ECC application (see Figure 1.6 and Table 1.13 below)

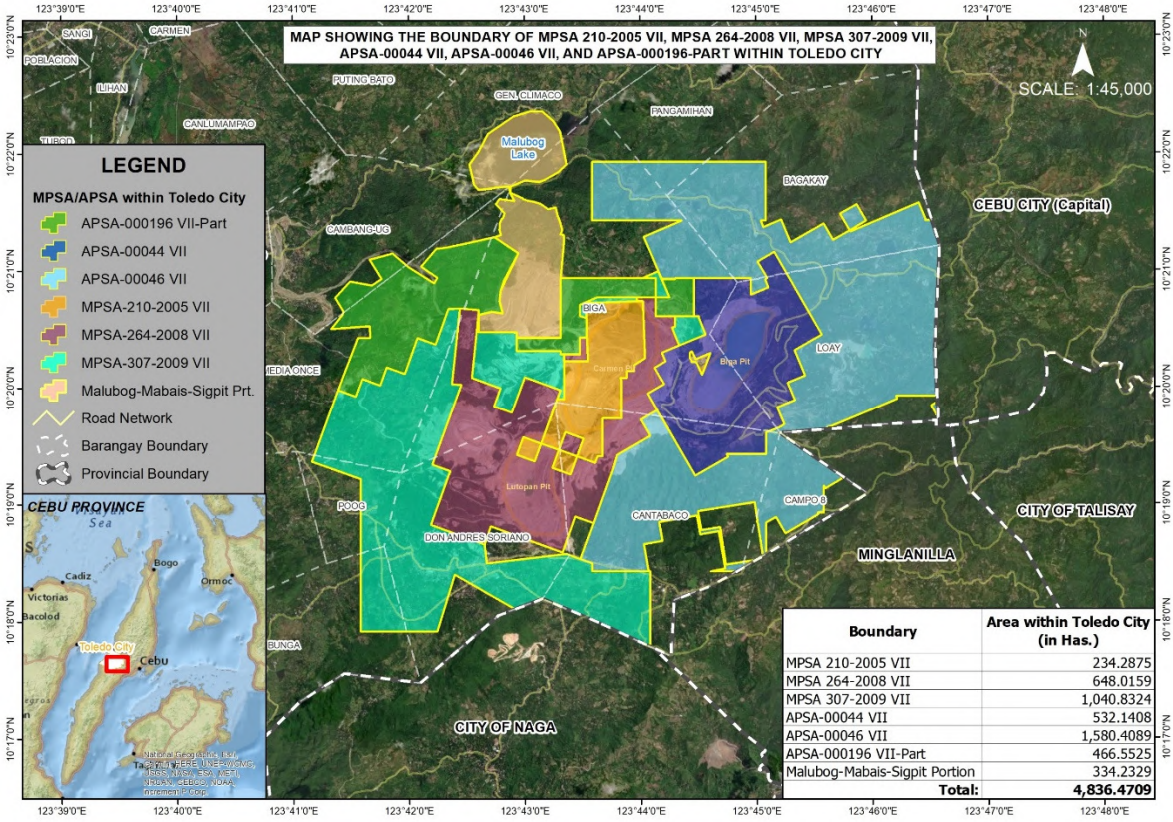


Figure 1.6 **Tenement Map Showing the ACMDC Properties, MPSA, APSA Areas**

Table 1.13 Consolidation of MPSAs, APSAs, ACMDC Properties and ECC Applied Area

Area/Component3		Tenurial Instrument	Area (in Has.)	ECC Applied/ Covered Area (in Has.)
1	**Mine Operations Area**	**MPSA 210-2005 VII**	234.2875	234.2875
		MPSA 264-2008 VII	648.0159	648.0159
		MPSA 307-2009 VII	1,274.1270	1,040.8324
		APSA 00044 VII	532.1408	532.1408
		APSA 00046 VII	1692.8895	1,580.4089
		APSA 000196-PART	764.7666	466.5525
2	**Malubog Lake**	TD Nos.: 96-149018-00493 99-149018-00746 2005-149018-00779 2008-149018-00817	164.7094 *(based on current water level)*	132.5966
	Mabais & Sigpit Channel/ Pipeline ROW *(including Mabais Waste Dump)*	TD Nos.: 2008-149016-05498 2008-149005-01624 96-149016-0003 96-149106-00042 2008-149010-05499 2008-149016-05502	201.7670	201.7670
3	**Atlas Port**	TD Nos.: 2009-149032-00140 2010-149032-00145 2009-149032-00136	12.6374	12.6374
	TOTAL		**5,525.3411**	**4,849.239**

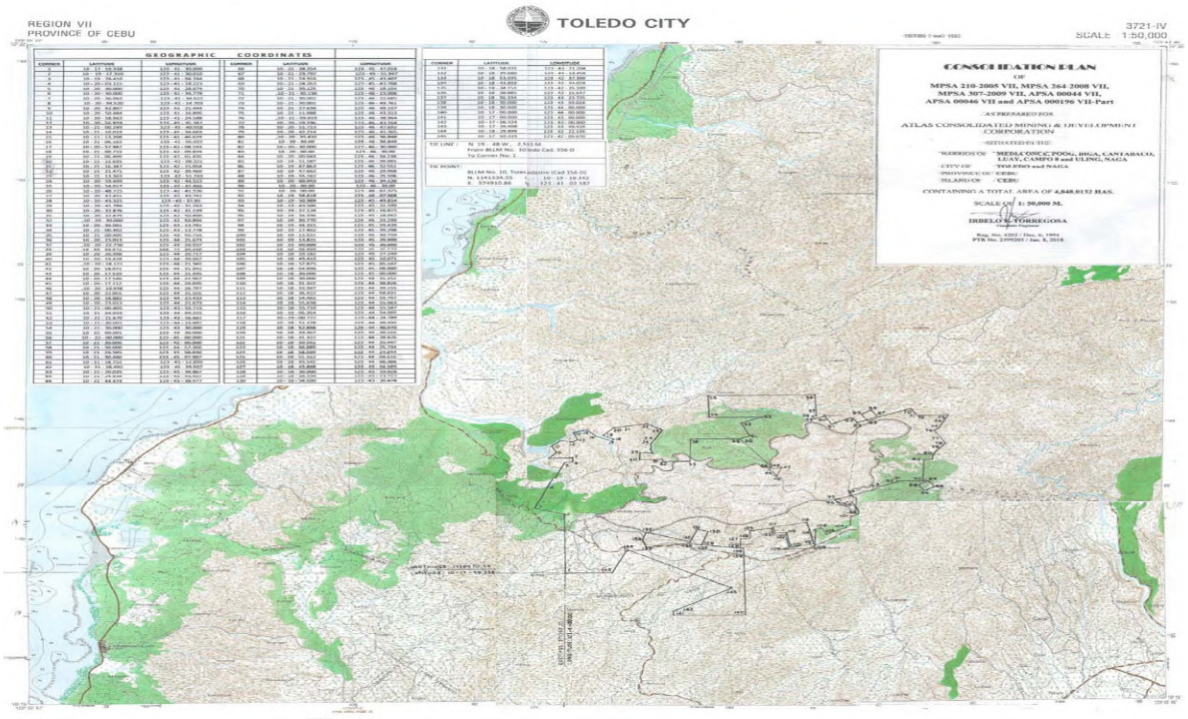


Figure 1.7 Geographical Map With Geographic Coordinates

Table 1.14 Geographical Coordinates of Toledo Copper Mines ECC Covered Area (Mine to Port)

A. MINE AREA

Corners	Latitude	Longitude	Corners	Latitude	Longitude
1	10° 17' 59.334"	123° 41' 30.002"	91	10° 20' 19.099"	123° 44' 23.104"
2	10° 19' 17.322"	123° 41' 29.907"	92	10° 20' 23.229"	123° 44' 21.340"
3	10° 19' 26.395"	123° 41' 4.650"	93	10° 21' 00.60"	123° 43' 55.353"
4	10° 20' 30.025"	123° 41' 28.359"	94	10° 21' 04.215"	123° 44' 3.852"
5	10° 20' 30.031"	123° 41' 34.574"	95	10° 21' 21.870"	123° 43' 56.270"
6	10° 20' 36.095"	123° 41' 34.409"	96	10° 21' 30.225"	123° 44' 16.062"
7	10° 20' 34.530"	123° 41' 14.509"	97	10° 21' 30.172"	123° 43' 29.620"
8	10° 20' 41.765"	123° 41' 20.310"	98	10° 22' 0.179"	123° 43' 29.579"
9	10° 20' 43.558"	123° 41' 20.847"	99	10° 22' 0.278"	123° 44' 59.505"
10	10° 20' 50.50"	123° 41' 16.678"	100	10° 21' 30.272"	123° 44' 59.546"
11	10° 20' 58.989"	123° 41' 24.353"	101	10° 21' 30.269"	123° 44' 56.914"
12	10° 20' 56.857"	123° 41' 35.506"	102	10° 21' 26.855"	123° 44' 58.381"
13	10° 21' 0.293"	123° 41' 40.667"	103	10° 21' 30.681"	123° 45' 7.446"
14	10° 21' 10.058"	123° 41' 34.405"	104	10° 21' 19.037"	123° 45' 12.449"
15	10° 21' 13.257"	123° 41' 46.361"	105	10° 21' 28.798"	123° 45' 29.460"
16	10° 21' 6.225"	123° 41' 54.751"	106	10° 21' 20.344"	123° 45' 34.397"
17	10° 20' 58.061"	123° 42' 7.924"	107	10° 21' 25.236"	123° 45' 42.924"
18	10° 21' 0.810"	123° 42' 09.60"	108	10° 21' 30.127"	123° 45' 51.450"
19	10° 21' 6.567"	123° 42' 01.160"	109	10° 21' 38.581"	123° 45' 46.514"
20	10° 21' 15.714"	123° 42' 9.027"	110	10° 21' 33.689"	123° 45' 37.986"
21	10° 21' 16.433"	123° 42' 14.754"	111	10° 21' 25.236"	123° 45' 42.924"
22	10° 21' 21.585"	123° 42' 39.142"	112	10° 21' 24.583"	123° 45' 43.305"
23	10° 21' 22.839"	123° 42' 42.412"	113	10° 21' 39.488"	123° 46' 18.622"
24	10° 21' 25.428"	123° 42' 41.764"	114	10° 21' 30.501"	123° 46' 22.483"
25	10° 21' 28.824"	123° 42' 41.815"	115	10° 21' 30.367"	123° 46' 22.163"
26	10° 21' 30.995"	123° 42' 42.789"	116	10° 21' 30.370"	123° 46' 25.545"
27	10° 21' 31.429"	123° 42' 43.622"	117	10° 21' 17.760"	123° 46' 29.617"
28	10° 21' 33.994"	123° 42' 44.349"	118	10° 20' 25.329"	123° 46' 27.129"
29	10° 21' 38.513"	123° 42' 39.775"	119	10° 20' 0.353"	123° 46' 28.379"
30	10° 21' 38.890"	123° 42' 40.279"	120	10° 19' 57.420"	123° 46' 28.526"
31	10° 21' 41.026"	123° 42' 41.604"	121	10° 19' 49.101"	123° 46' 28.942"
32	10° 21' 41.424"	123° 42' 42.410"	122	10° 19' 55.511"	123° 46' 25.199"
33	10° 21' 40.956"	123° 42' 42.899"	123	10° 19' 57.420"	123° 46' 28.526"
34	10° 21' 40.695"	123° 42' 45.792"	124	10° 20' 0.353"	123° 46' 28.379"
35	10° 21' 40.675"	123° 42' 45.789"	125	10° 20' 0.330"	123° 46' 6.986"
36	10° 21' 40.206"	123° 42' 49.454"	126	10° 19' 58.948"	123° 46' 7.581"
37	10° 21' 44.342"	123° 42' 47.056"	127	10° 19' 51.297"	123° 45' 49.452"
38	10° 21' 47.193"	123° 42' 46.825"	128	10° 19' 43.792"	123° 45' 31.262"
39	10° 21' 47.239"	123° 42' 46.832"	129	10° 19' 43.015"	123° 45' 29.420"
40	10° 21' 47.635"	123° 42' 45.882"	130	10° 19' 41.233"	123° 45' 6.842"
41	10° 21' 47.545"	123° 42' 44.895"	131	10° 19' 20.235"	123° 45' 37.504"
42	10° 21' 46.667"	123° 42' 37.771"	132	10° 19' 17.692"	123° 45' 38.990"
43	10° 21' 46.457"	123° 42' 36.021"	133	10° 19' 12.80"	123° 45' 30.464"
44	10° 21' 45.890"	123° 42' 31.403"	134	10° 19' 14.10"	123° 45' 29.703"

45	10° 21' 46.029"	123° 42' 30.658"	135	10° 19' 0.276"	123° 45' 29.723"
46	10° 21' 48.470"	123° 42' 28.626"	136	10° 19' 0.272"	123° 45' 26.398"
47	10° 21' 58.854"	123° 42' 26.118"	137	10° 18' 59.455"	123° 45' 26.875"
48	10° 22' 05.469"	123° 42' 30.906"	138	10° 18' 49.671"	123° 45' 9.824"
49	10° 22' 14.418"	123° 42' 35.711"	139	10° 18' 58.123"	123° 45' 4.888"
50	10° 22' 23.335"	123° 42' 48.749"	140	10° 18' 55.177"	123° 44' 59.754"
51	10° 22' 26.052"	123° 42' 57.381"	141	10° 18' 39.091"	123° 44' 59.776"
52	10° 22' 25.949"	123° 43' 03.846"	142	10° 18' 38.143"	123° 44' 58.172"
53	10° 22' 20.994"	123° 43' 09.748"	143	10° 18' 54.698"	123° 44' 55.505"
54	10° 22' 15.816"	123° 43' 13.145"	144	10° 18' 55.870"	123° 44' 54.820"
55	10° 21' 58.894"	123° 43' 16.491"	145	10° 18' 55.947"	123° 44' 55.304"
56	10° 21' 54.726"	123° 43' 11.886"	146	10° 19' 05.591"	123° 44' 53.750"
57	10° 21' 50.827"	123° 43' 04.951"	147	10° 19' 0.975"	123° 44' 24.564"
58	10° 21' 49.942"	123° 43' 02.236"	148	10° 18' 51.331"	123° 44' 26.119"
59	10° 21' 50.695"	123° 42' 54.966"	149	10° 18' 52.870"	123° 44' 35.847"
60	10° 21' 47.518"	123° 42' 47.360"	150	10° 18' 33.581"	123° 44' 38.955"
61	10° 21' 47.121"	123° 42' 47.589"	151	10° 18' 36.064"	123° 44' 54.657"
62	10° 21' 44.318"	123° 42' 47.608"	152	10° 18' 31.625"	123° 44' 47.147"
63	10° 21' 41.628"	123° 42' 53.630"	153	10° 18' 30.219"	123° 44' 44.579"
64	10° 21' 40.909"	123° 42' 54.241"	154	10° 18' 30.204"	123° 44' 30.963"
65	10° 21' 40.470"	123° 42' 55.921"	155	10° 18' 31.535"	123° 44' 38.629"
66	10° 21' 39.713"	123° 42' 59.685"	156	10° 18' 50.774"	123° 44' 35.227"
67	10° 21' 38.858"	123° 43' 02.965"	157	10° 18' 49.091"	123° 44' 25.525"
68	10° 21' 36.133"	123° 43' 06.689"	158	10° 18' 58.711"	123° 44' 23.823"
69	10° 21' 36.096"	123° 43' 07.567"	159	10° 18' 55.342"	123° 44' 4.416"
70	10° 21' 36.815"	123° 43' 10.832"	160	10° 18' 45.722"	123° 44' 6.117"
71	10° 21' 32.862"	123° 43' 11.842"	161	10° 18' 44.036"	123° 43' 56.414"
72	10° 21' 30.105"	123° 43' 12.895"	162	10° 18' 30.170"	123° 43' 58.866"
73	10° 21' 25.547"	123° 43' 14.239"	163	10° 18' 36.464"	123° 43' 23.583"
74	10° 21' 24.578"	123° 43' 14.078"	164	10° 18' 54.833"	123° 43' 30.298"
75	10° 21' 23.136"	123° 43' 13.172"	165	10° 18' 58.163"	123° 43' 21.035"
76	10° 21' 22.774"	123° 43' 14.892"	166	10° 18' 39.80"	123° 43' 14.323"
77	10° 21' 19.728"	123° 43' 15.122"	167	10° 18' 53.117"	123° 42' 37.273"
78	10° 21' 0.550"	123° 43' 13.451"	168	10° 18' 43.935"	123° 42' 33.917"
79	10° 21' 0.600"	123° 43' 55.353"	169	10° 18' 34.227"	123° 42' 35.058"
80	10° 20' 23.229"	123° 44' 21.340"	170	10° 18' 39.008"	123° 43' 16.508"
81	10° 20' 22.945"	123° 44' 20.605"	171	10° 18' 36.464"	123° 43' 23.583"
82	10° 20' 22.556"	123° 44' 20.338"	172	10° 18' 30.170"	123° 43' 58.866"
83	10° 20' 21.203"	123° 44' 20.388"	173	10° 18' 30.170"	123° 43' 59.837"
84	10° 20' 19.642"	123° 44' 20.340"	174	10° 17' 51.619"	123° 43' 59.889"
85	10° 20' 18.336"	123° 44' 21.016"	175	10° 18' 3.412"	123° 43' 34.344"
86	10° 20' 17.725"	123° 44' 21.010"	176	10° 18' 16.146"	123° 43' 4.102"
87	10° 20' 17.763"	123° 44' 22.641"	177	10° 18' 10.723"	123° 42' 49.710"
88	10° 20' 17.330"	123° 44' 23.708"	178	10° 18' 28.493"	123° 42' 18.513"
89	10° 20' 11.158"	123° 44' 26.476"	179	10° 17' 59.373"	123° 42' 9.639"
90	10° 20' 22.282"	123° 44' 30.816"			

B. SANGI PORT

Corners	Latitude	Longitude
1	10° 23' 24.613"	123° 38' 27.950"
2	10° 23' 25.010"	123° 38' 30.825"
3	10° 23' 25.452"	123° 38' 30.757"
4	10° 23' 25.189"	123° 38' 31.711"
5	10° 23' 24.555"	123° 38' 31.540"
6	10° 23' 24.329"	123° 38' 32.379"
7	10° 23' 24.911"	123° 38' 32.581"
8	10° 23' 24.298"	123° 38' 34.313"
9	10° 23' 23.309"	123° 38' 34.754"
10	10° 23' 23.552"	123° 38' 33.624"
11	10° 23' 23.107"	123° 38' 33.095"
12	10° 23' 22.460"	123° 38' 32.352"
13	10° 23' 22.162"	123° 38' 31.004"
14	10° 23' 23.059"	123° 38' 31.130"
15	10° 23' 23.565"	123° 38' 31.078"
16	10° 23' 23.079"	123° 38' 28.312"
17	10° 23' 21.644"	123° 38' 20.993"
18	10° 23' 22.304"	123° 38' 18.098"
19	10° 23' 22.371"	123° 38' 17.796"
20	10° 23' 23.249"	123° 38' 15.367"
21	10° 23' 23.160"	123° 38' 15.340"
22	10° 23' 23.998"	123° 38' 12.898"
23	10° 23' 24.329"	123° 38' 12.642"
24	10° 23' 24.199"	123° 38' 12.464"
25	10° 23' 24.039"	123° 38' 12.572"
26	10° 23' 18.480"	123° 38' 10.700"
27	10° 23' 20.353"	123° 38' 04.726"
28	10° 23' 28.462"	123° 38' 07.400"
29	10° 23' 27.839"	123° 38' 09.253"
30	10° 23' 31.425"	123° 38' 10.435"
31	10° 23' 29.933"	123° 38' 14.872"
32	10° 23' 29.182"	123° 38' 17.106"
33	10° 23' 26.207"	123° 38' 16.235"
34	10° 23' 25.894"	123° 38' 17.164"
35	10° 23' 25.168"	123° 38' 19.325"
36	10° 23' 24.621"	123° 38' 20.950"
37	10° 23' 26.313"	123° 38' 21.546"
38	10° 23' 24.136"	123° 38' 28.062"

1.2.4 Project Milestone, Rationale/Objective

1.2.4.1 Project Milestone

ACMDC Mining Operations and Socio-Economic Contributions: 1953 - 1994[1]

In 1953, ACMDC began its copper mining operations in Toledo. Using combined open pit and underground mining technology, Atlas commenced ore production in 1955.

In the late 1970s, ACMDC became Asia's largest copper mine and continued to generate revenues for the government through taxes. At the height of its operations, the company's total average mineable material output per day was 100,000 – 110,000 tonnes and its staff complement comprised 14,000 people

In its active years, ACMDC built housing structures, recreation centers, day-care centers, a chapel and a modern hospital with a 99-bed capacity in Toledo City. It also established and subsidized the Andres Soriano Memorial School, a De La Salle University-affiliated school, for its employees and the local communities.

Through its Community Development Division, ACMDC also implemented or financed livelihood programs such as aquaculture, cattle, swine, and poultry raising, vegetable growing, wood craft making, loom weaving that produced blankets and towels, and production of ropes, bags, gloves and safety shoes (Cal, 2003). The company also organized farmer's associations and rural development groups as part of its socio-economic program for the host communities.

In 1994, ACMDC suspended its operations in Toledo City due to the low world market price of copper, flooding of its underground mines, and financial constraints for the necessary rehabilitation, and internal labor problems.

Toledo City officials claim that the conversion of Toledo into a city made possible through revenues from Atlas mining, is one of the positive legacies of ACMDC mining in Toledo[2]

2008 Reopening to Present Day

Overall, its total economic contribution has been growing since restarting in 2008 operations. Carmen Copper contributes to the economy through jobs and livelihood opportunities, taxes paid to the national and local governments, businesses generated by local suppliers, support for community development and public infrastructure programs.

In 2012, Carmen Copper registered Php 14.3 billion in revenues and Php9.5 billion in operating expenditures. Total taxes for 2012 amounted to Php906 million (inclusive of input VAT, customs duties, excise taxes, local government taxes, and withholding taxes), with Php820 million paid to the national government and Php86 million paid to local government units. The Company also contributed to the economy annual wages of Php759 million in 2012. Carmen Copper has been awarded as one of the top taxpayers in Toledo City in 2011 and 2012 while the Bureau of Customs also recognized Carmen Copper as one of the top exporters and importers in Cebu.[3]

[1] Philippine Working Group on Mining/Environmental Science for Social Change. March 2008. "2003 Legacy Mines Visit: Atlas Consolidated Mining Development Corporation Toledo City, Cebu Environmental and Community Impact"

[2] By 1963, the once-sleepy town of Toledo had been elevated into a city by an Act of Congress, the city built by a mineral and only the second city of Cebu at the time (Bersales, 2018)

[3] Carmen Copper Corporation 2012 Sustainability Report

1.2.4.2 Contribution to National, Regional and Local Development Goals

the International Council of Mining and Metals ICMM) 2012 reports "*affirmed that mining industries positively contribute to a country's economy particularly on aspects of foreign direct investment and national revenues and employment generation… [u]nder optimal conditions and with strict compliance to national laws and regulations, a mining project has the potential to be a catalyst for economic and social development as society is wholly dependent on the products of mining*.[4]" MGB reported that "the *The Philippine mining industry contributed ₱102.3 billion to the Gross Domestic Product (GDP) in 2020 despite the challenges posed by the COVID-19 pandemic".*[5]

The MGB reported in its Central Visayas Region 'Mineral Profile' the following information:

- that the mining industry in the region has contributed 4.58 Billion or 0.9% of the GRDP of Region 7[6]
- The value of metallic and non-metallic minerals extracted in the region were 12.8 billion and 1.2 billion, respectivel. Although majority of the mining operations in Central Visayas is for non-metallic minerals which is valued at P 1.2 Billion, Central Visayas is poised to be the largest Copper Concentrate producer in the Philippines. The total value of the metallic mineral products, P12.8 Billion is from copper concentrate and its by-products – gold and silver.
- A total of 4,507 employees regular and contractual employees were hired (excluded those of contracting services)
- A contribution of Php 7.4 billion of mining contractors, operators, and exploration permit holders to the Philippine economy through the amount paid for income tax, excise tax on mineral, customs duties and fees, value added tax, local business tax, real property tax, community tax among other national and local taxes
- A total amount of Php 357 million committed by operating mines for the development of their host communities through their approved SDMPs.

The 2021 Integrated Report of ACMDC noted the value of financial and non-financial benefits the TCM minin operations brings to its stakeholders, as indicated in the figure below:

[4] As quoted in Jacobs (2019)
[5] https://denr.gov.ph/index.php/news-events/press-releases/2935-denr-mgb-ph-mining-sector-contributes-102-3b-to-gdp-allots-379b-for-environmental-programs-in-2020#:~:text=The%20Philippine%20mining%20industry%20contributed,(DENR)%20on%20June%2021.
[6]

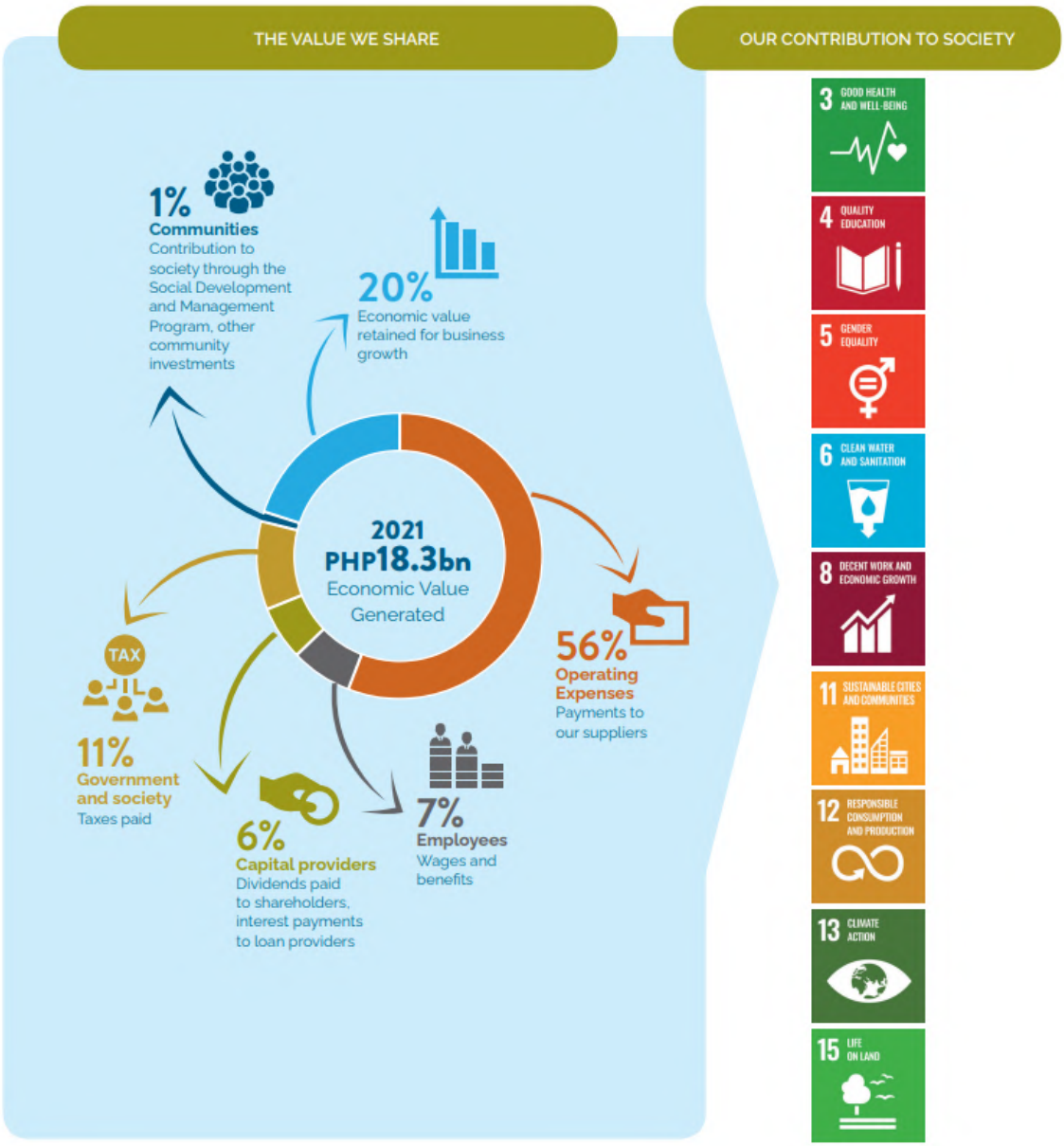


Figure 1.8 ACMDC/TCM Benefits Share to Stakeholders and Contribution to Society
(Source: ACMDC 2021 Integrated Report)

1.2.4.3 Project Rationale/Objective

The Company's community development programs are selected on the basis of their feasibility to improve the quality of life of people in the host communities. "We ensure meaningful and open engagement with our stakeholders for long-term mutual benefits and inclusive growth." Carmen Copper assists in the development of host and neighboring barangays (villages) where it operates through projects and activities that address issues on human resource development & institutional building; enterprise development; assistance to infrastructure development & support services; access to education & educational support; access to health services, health facilities & health professionals; protection and respect of socio-cultural values; and use of facilities/ services inside the mine camp.

These social development initiatives are financially supported through the allocation of a fixed annual budget equivalent to 1% of the Company's direct mining and milling costs. The barangays, the city, and its people, directly benefit from these projects, providing them with better access to basic services. Carmen Copper spent Php69.4 million for its Social Development and Management Program (SDMP) in 2012.

The Carmen Concentrator ore processing facility has been in operations since ACMDC started operating the Atlas Mines. The mining operations was suspended for some period of time and went back in operations in 2005-2006.

The mines was issued a CNC, however, areas undergoing improvement and expansion were procured ECCs (such as the Waste Rock Dumps and Tailings Storage Facilities).

Recently, the Toledo Copper Mines was about to undertake the following:

- Apply for an ECC for the proposed upgrading of the Carmen Concentrator (Carcon) facility, with the EMB-Central Office (a Project Description Report for the CarCon facility ECC application was submitted to EMB-CO.
- Apply for an ECC Amendment for its Airstrip Site WRD modifications.

However, it is being recommended to integrate all the existing ECCs issued into one ECC that will cover the entire Mining and Processing operations (Mine-to-Port) of Toledo Copper Mines (covering a total land area of 4,849.239 hectares), thus, the objective/purpose of this ECC Application/EIA-EPRMP study/report is to consider/include the following undertakings:

1. Integrate the previously issued ECCs for the WRDs and the BTSF into one ECC and those facilities/undertakings covered under the CNC
2. Enhancement of the Carcon Facility
3. Modifications of the Airstrip Waste Rock Dump facility (introduction of crushing facility and modification/expansion of the WRD area/capacity)

1.2.5 Project Alternatives

Site Alternatives. Given that the mine has long been in operations and that the facilities, utilities, infrastructures and amenities are already sited and in-place, present and future enhancement and developments will be basically dependent on the existing locations/placement of these facilities.

The 4,849.239 hectares covered by the TCM mine-to-Port Operations are mostly developed area for its existing mining operation. The site considerations for the proposed modifications covered under this Integration of ECCs application, namely: Carcon Facility and Airstrip WRDs modification/expansion, are as follows:

a. Carcon facility is already existing and in-placed, thus, there are no site alternatives considered
b. The Airstrip WRD is being proposed to be modified, with the cancellation of the Ilag area, but to be expanded on the other side. The primary consideration for cancellation of the Ilag area is to avoid the Ilag River and the adverse impacts of river/waterway diversion.

Technology Alternatives. The mine project aspects where alternatives were assessed include mining methods, mineral processing, mine wastes management (tailings and waste rocks), considers those mining and processing technology alternatives as indicated in Table 1.15, however, such mining and processing technology are already in-placed and operational, with no significant changes or introduction of major modifications through the TCMs operations.

Table 1.15 Mining and Processing Technology Alternatives

Criteria	Criteria	Alternative methods/ technology considered
Mining Method	• Ore body geometry • Available technology • Safety • Mining Cost	• Underground Mining/Block-caving extraction method • Open pit mining method
Disposal/Handling of Waste Rocks	• Environmental impacts • Capital & operating costs	• Waste Rock Dumps • Processing of Waste Rocks for construction materials
Mineral Processing	Geo-metallurgical properties of the ore Marketability of the final project(s) Available Technology Capital Cost	Beneficiation Process- 3 stages of dry crushing and single-stage wet grinding, recovery by rougher flotation, regrinding, 4-stage selective flotation, thickening, cycloning & filtration.
Tailings Storage Facility	• Available technology • Approval process • Environmental impacts • Capital cost • Availability of usable areas • Policy requirements (i.e. DMO 1999-322)	• Submarine-Sea disposal • Land-based tailings storage • Deposition of tailings as paste, thickened tailings or filtered tailings

1.2.6 Project Component

1.2.6.1 Entire Toledo Copper Mines site

The consolidated MPSAs, APSAs and ACMDC properties, where the CCC have its mine-to-port Operations, comprises a total area of 4,849.239 hectares (project area). The mine site lies within an existing and previously developed area with facilities and infrastructures already in place. The mine-to-port operations consists of three areas the mining operations area, malubog dam/lake, and the port facility

The major operations of Carmen Copper Mine Site, which are open-cast mining, milling, mine wastes management (waste rock and tailings), and the administration/maintenance defined the mine site land uses, facilities and components. The project components total building/facilities/inftrastructure footprint of 1,377.267 hectares comprises 28% of the total project area.

Table 1.16 TOLEDO COPPER MINES PROJECT COMPONENTS

PROJECT COMPONENT/FACILITY		Existing			Proposed	
		Status	Area (s.m)	Capacity	Area (s.m.)	Capacity
A	**Mining Operations**					
1	Carmen Pit	Operational/CNC	2,430,000	188.22 million metric tons		
2	Lutopan Pit	Operational/CNC	1,021,200	26.42 million metric tons		
3	Mine Open Pit Office	Operational/CNC	790			

4	Carmen Pit Sub-station	Operational	424.28			
B	**Waste Rock Dumps**					
5	Airstrip-Ilag	Operational (ECC R07-1012-0379	1,788,270	170 million tons		
6	Sigpit	ECC RO7 0612-290278-0120	2,574,900	314.10 million tons		
7	Aggregates/Crushing Facility				20,900	1.8 million MT per year
8	WRD modification/Expansion				691,100	51 million MT
9	Marcona	Not operational (Amended ECC 07-0612-290278 120)	690,800	92 million tons		
C	**CARCON Facility**	Operational		60MTD (milling capacity)		
10	Lime/Steel Ball Warehouse		3,313.45			
11	Primary Crusher 1		43,393	2,500 tons per hour		
12	Slaking		1,268.47			
13	Screening Plant		17,438	4,000 tons per hour		
14	Coarse Ore Stockpile		3,478.84	120,000 tons		
15	Fine Ore Bin		10,612	90,000 metric tons		
16	Tailings Thickener		26,336.50			
17	Carcon Metlab		120			
18	Carcon Mill		28,921.27	170.79 million metric tons		
19	Secondary-Tertiary Crusher		13,091	3,200 tons per hour		
20	Primary Crusher 2		21,788	1,000 ton per hour		
21	Ore Sorting Facility				26,795	1,000 tons per hour
22	CD Office & Warehouse				4,140	
D	**Tailings Disposal Facility**	Operational				
23	Stage 1 Pumphouse		2,366.86	1,844 tons per hour	2,366.86	1,844 tons per hour
24	GEHO PD Tailings Pumps		3,204.86	2,442 tons per hour	3,204.86	2,442 tons per hour
25	Stage 2 Pumphouse		1,243.91	1,844 tons per hour	1,243.91	1,844 tons per hour
26	Stage 3 Pumphouse		3,000	1,300 tons per hour	3,000	1,300 tons per hour
27	Biga Tailings Storage Facility (Including 12-chamber Settling Pond)	Operational (ECC RO7 06 12-29 0278-0120)	3,305,537.76	341.2 million tons		
28	Sigpit Silting/Settling pond	Operational	12,604.95	52,562 cu.m		
29	Emergency Tailings Pond	Operational	30,817.51	35,737.72 cu.m		

30	Udlom Settling Pond	Operational	6,480.87			
E	**MAINTENANCE & SERVICES**	Operational				
31	Carmen HE Shop	Operational	30,371.33			
32	Annex A-Refueling Station	Operational	3,802			
33	HE Welding Shop	Operational	2,232.30			
34	Transport Shop	Operational	3,680			
35	MMD Warehouse	Operational	20,990.60			
36	ASSAY Laboratory	Operational	2,415.13			
37	Fabrication (Machine) Shop & Blacksmith	Operational	5,049.76			
F	**UTILITIES**					
38	Malubog Dam (Water Supply)	Operational	1,492,703	12.9 million cu.m		
39	Abaca Water Treatment Plant	Operational	6,594.70	16,996.35 cu.m		
40	25MW Thermal Power Plant	Operational (Stand-by power)	7,817			
41	Power Sub-Station (2 areas)	Operational	4,453.58			
G	**FORESTATION, ENVI FACILITIES**					
42	Eco Park	Operational	20,000			
43	Plant Nursery	Operational	3,186.53	250,000 seedlings		
44	Reforestation, plantation area	Properly maintained (area presented is as of 2020)	1,927.75			
45	MRF, composting facility, etc.	Operational	20,000	60,000 cu.m		
H	**ADMIN, SOCIAL/ COMMUNITY FACILITIES**					
46	CCC Hospital	Operational	13,446.86			
47	Staff Clubhouse	Operational	958.68			
48	CCC Amin, ICB & ICT Building	Operational	2,403			
49	Security Headquarters	Operational	158.40			
50	CCC Recreation Center	Operational	4,458.25	700 heads		
51	Museum	Operational	3,200			
I	**PORT FACILITY**					
52	Port Facility	Operational	81,421			
	TOTAL Building/Facilities/ Infrastructure footprint		**13,772,671.40**			

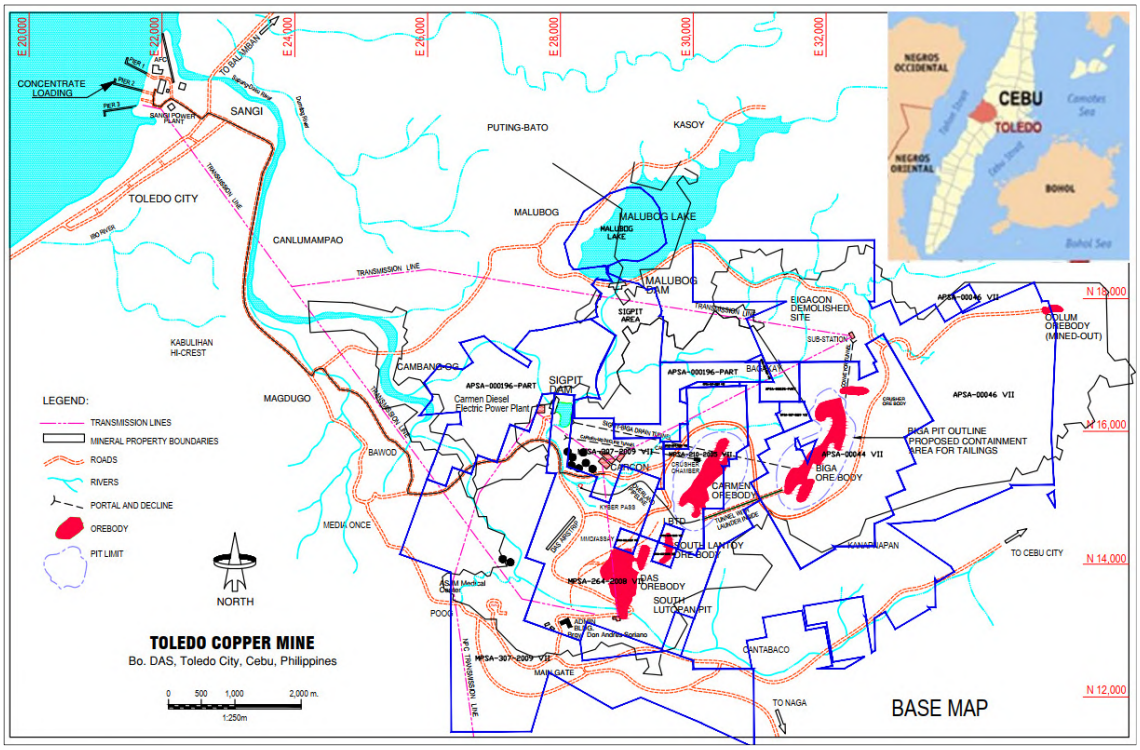


Figure 1.9. Toledo Copper Mine Area Coverage

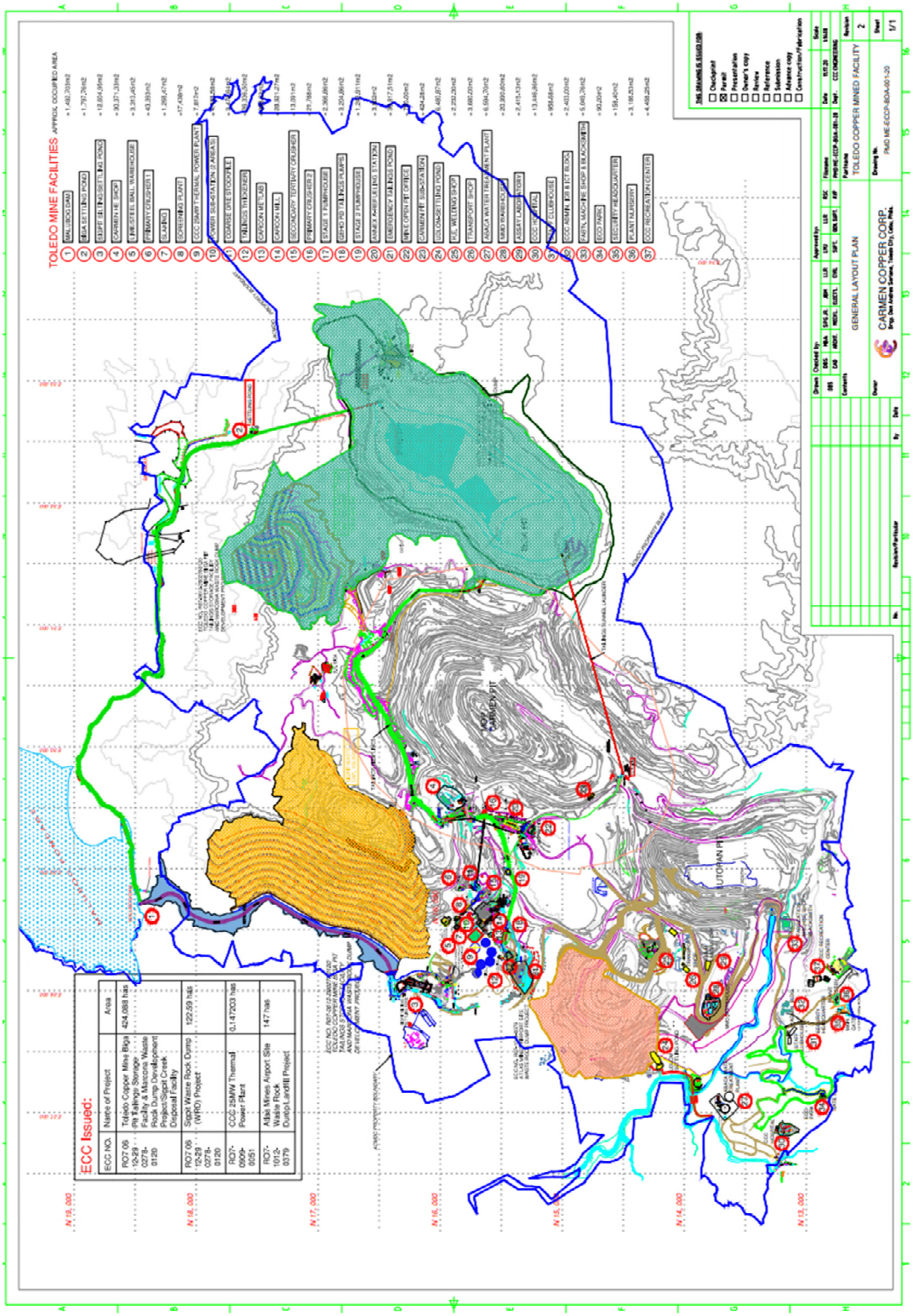


Figure 1.10 Toledo Copper Mines Site Development Layout

1.2.6.2 Brief Description of Major Mining, Processing and Port Facility Components

1.2.6.2.1 Underground and Open Pits

In the initial feasibility study, for the revived operations, the Carmen orebody will be mined by open-cast and later by underground method. With this, the inactive Carmen Pit and its extended Carmen Underground (CUG) Lift-1 workings are being dewatered, cleared of muck and rehabilitated.. However, CCC management informed MGB VII (letter dated March 10, 2011), its change in mining plans of MPSA NO. 210-2005-VII (Carmen Orebody) from a combination of open pit and undergound method to solely by open pit mining.

Carmen Pit

The Carmen Pit covers an area footprint of 2,430,000 square meters and a capacity of 188.22 million metric tons.

Mining operations/ore extraction is currently concentrated on Carmen Pit – the primary source for commercial production, while at the same time developing Pit B which will be concentrated not only on a regular waste stripping activity but also the debris removal as a result of the slide incident in late 2021.

Lutopan Pit

The Lutopan Pit covers an area footprint of 1,021,200 square meters and ore capacity of 26.42 million tons. The Lutopan Pit comprises the South and North Lutopan Pit

Planned activities for Lutopan Pit are as follows: stripping is programmed to start at B+345 by 2029 onwards.

1.2.6.2.2 Carmen Concentrator (CarCon) Facility

The run-of-mine ore from mine pits are being delivered by 100-tonner dump trucks to the Carmen Concentrator for processing. The CarCon facility complex covers a total land area of 84.318 hectares has the following component-facilities.

Table 1.17 CarCon Facility/Area Component

Existing	New/Additional Machineries
2-units Gyratory Crushers	2-units Secondary Ball Mill w/ Drive Motor
1-unit Picking Conveyor	2-units Secondary Ball Mill Discharge - Cyclone Feed Pump
1-unit Decline Conveyor	2-units Secondary Ball Mill - Spillage Pump
2-units Overland Conveyors	2-units Secondary Ball Mill Trash Screen
5-units Center Conveyors	2-units Cyclone Cluster
12-units Through Conveyors	1-unit Secondary Mill Splitter Box
4-units Pan Feeders	1-unit Rougher Feed Splitter Box
33-units Belts Feeders	4-units TC300 Flotation Cell & Agitator
5-units Double Deck Screens	8-units HG Cleaner Flotation Cell Agitator
10-units Single Deck Screens	2-units HG Cleaner Concentrate Pump

3-units Secondary Hydrocone Crushers	2-units Train A Rougher Flotation Tailings Transfer pump
5-units Tertiary Hydrocone Crushers	2-units Concentrate LG Transfer Pump
7-units Ball Mills	3-units Flotation Blower
1-unit Regrind Ball Mill	
2-units 300 MT CUG Surge Bins	
1-unit 700 MT Surge Bin	
1-unit 4300 MT Live Capacity Screen Ore Bin	
1-unit 90,000 MT Live Capacity Fine Ore Bin	

1.2.6.2.3 Tailings Disposal Facilities

The disposal method is essentially a tailings transmission and containment system that utilizes the Biga Pit as the placement site for tailings.

Initially, the final tailings are transported by gravity and distributed towards seven thickeners, each measuring 250 feet in diameter by 12 feet high, and equipped with 15 HP peripherally-driven rakes. The tailings are thickened to a slurry containing 48 % to 52 % solids before flowing through three (3) 8-inch diameter underflow pipes. All thickeners' underflows converge at a common take-off sump. From there, the tailings slurry are caused to gravitate towards thepump sump where they are thickened to about 65 % solids before being piped finally to the Biga pit containment site.

The tailings transmission system consists of two sections – an initial overland pipeline set-up from CARCON to the Carmen Throughcut and a tunnel-launder component that daylights at the Biga pit. The overland pipeline is about 2.10kms. whereas the tunnel section is approximately 1.60 kms.

The land-based system utilizes a single slurry pumping stage that takes off at a common sump at the CARCON thickeners (elevation of + 150 meters above sea level and flows towards the Biga pit outfall at elevation +400 masl. The overland pipe terminates at the vicinity of the Carmen Throughcut (elevation + 420 masl) before joining the launder line laid out inside the tunnel. The resulting tunnel grade is + 1.0% from the entry portal to the Biga pit outfall

The Amended ECC 07-0612-290278 120 (issued October. 21, 2018) which covered the Biga Pit Tailings Storage Facility (TSF) Enhancement & Marcona WRD, introduces modifications to the above-mentioned tailings transmission and containment system.

Table 1.18 Tailings Disposal Facility Component

	ECC PROJECT COMPONENTS	***REMARKS***
1	***HANDLING OF TAILINGS***	
	Development of new 4.5 kms tailings pipeline and pumping stations	Generally overland
	Emergency Tailings Pond (0.71 has)	Cancelled in the amended ECC
2	***STORAGE OF TAILINGS***	
	Biga Pit (Area: 331 hectares). The present maximum impoundment of Biga Pit Storage level is at elevation 380 meters. The plan is to raise the capacity level to Elevation 420 meters, thus a dike will be constructed.	Enhancement & development of the Biga North Dike, inclusive of: Construction of engineered fill 85m dike; Upgrading of

		existing Decant tower water overflow structure
3	***HANDLING/TREATMENT OF WATER OVERFLOW***	
	a. Lime Injection Plant	Retained in the amended ECC
	b. Decant Tower	Increase in height.
	c. Wastewater Treatment Facility	Retained
	d. Pipeline for Water Relief Overflow (9.08 has)	Retained
	d.1 Pipeline through Bigacon tunnel Conveyor (0.23 has.)	
	d.2 Bigacon to Malubog Dam (3.0 has.)	
	d.3 Malubog dam to Sedimentation pond (stretch of Upper Sigpit)-5.85 has.	
4	***Recycling and disposal of water overflow***	
	a. Sigpit Sedimentation Pond (1.28 has)	Cancelled in the Amended ECC
	b. Sigpit dam for disposal of water overflow	Retained
	c. Pipeline for recycle water leading to the existing water tank with storage capacity of 50,456 cu.mtrs.	Retained

Capacity of the BTSF. The current ECC indicated that the total volume of available void between two horizons of 168,716,000 cu.mtrs, equivalent to an impounding capacity of 252,000,000 tailings tonnages at peak milling capacity for 42,0000 metric tons/day of ore of Carmen Concentrater. With this enhancement project the impounding capacity of the BTSF will be increased to ***213,235,123 cu.mtrs (DMT) or 341,176,197 tons*** (at elevation 420m.)

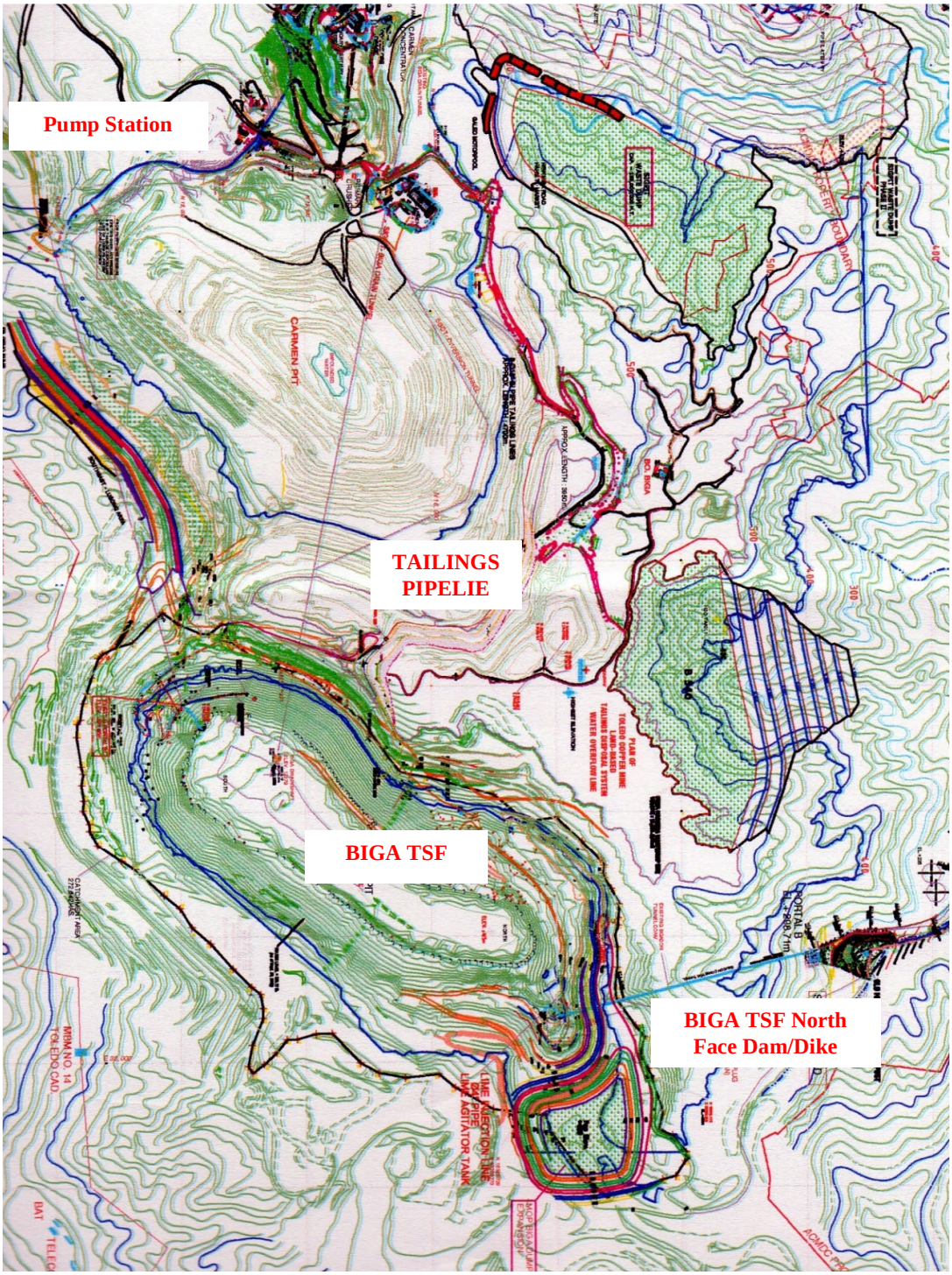


Figure 1.11. Tailings Disposal Facilities Development Layout

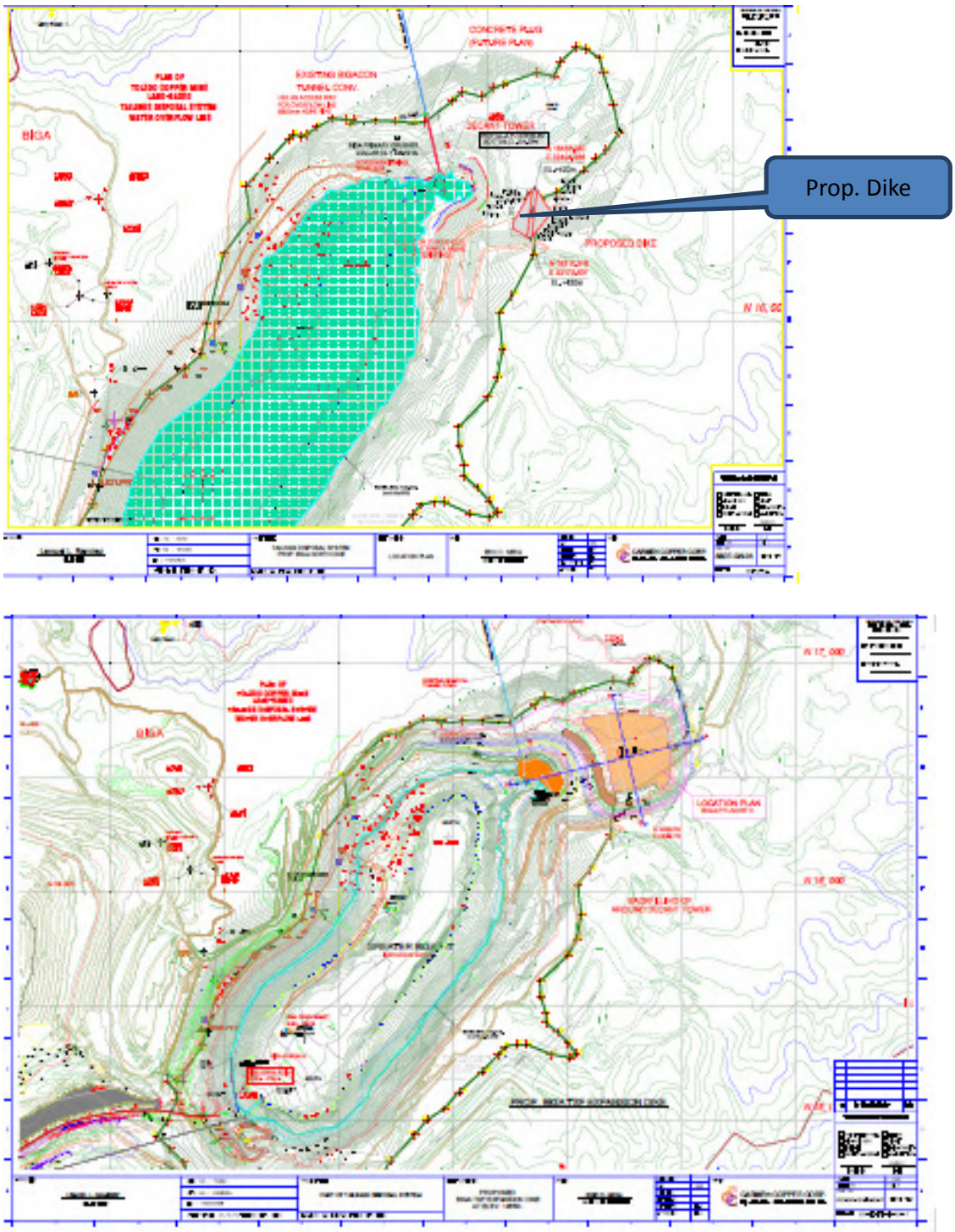


Fig. 1.12 Site Development Plan for the Biga TSF Enhancement Project

1.2.6.2.4 Waste Rock Dump/Landfill Facilities

The Toledo Copper Mines has a number of old/abandoned wastes dumps and WRD facility that is currently being utilized (Airstrip Site WRD) and the proposed Marcona WRD.

1.2.6.2.4.1 Airstrip Site WRD

The Airstrip WRD occupies a land area of 75 hectares with a capacity of 170M Tons, with the Ilag expansion area having an area of 72 hectares and can accommodate 51M Tons of waste rock. The Airstrip Site-Ilag WRD covers a total land area of 147 hectares, and a total capacity of 221 Million Tons of Waste Rock. A description of the two components (Airstrip WRD-1st Phase) and the Ilag-Expansion WRD (2nd Phase) are as follows:

a) *Airstrip Waste Dump Area*: Rock waste dump with an elevation of 405 meters having a Top Area of 14.0691 hectares, and a bottom area of 73,9282. Road networks, barrier bund, and circumferential drainage system leading to the 2-units settling ponds prior to final discharge of the Ilag River. The total area for the Airstrip site WRD will comprise 75 hectares.

b) *Ilag Waste Dump Area-Expansion*: Rock waste dump area with an elevation of 285 meters having a top area of 28.3075 hectares, and a bottom area of 66.8615 hectares. Road networks, barrier bund and Ilag diversion channel with a length of 775 linear meters leading to the boxed culver to be connected to 1-unit settling/sedimentation pond prior to its final discharge to Ilag River. The total area for the Ilag WRD Expansion will comprise 72 hectares.

The Airstrip WRD is being proposed to be modified, with the cancellation of the Ilag area, but to be expanded on the other side and the introduction of waste rock processing facility for utilization as construction material.

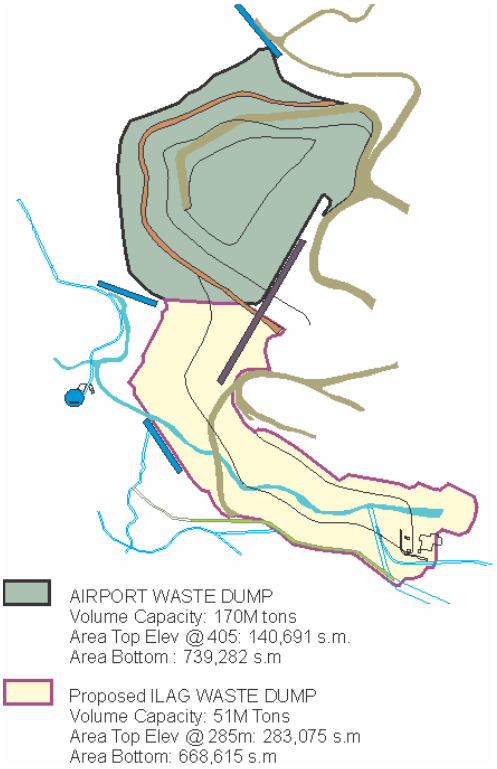

AIRPORT WASTE DUMP
Volume Capacity: 170M tons
Area Top Elev @405: 140,691 s.m.
Area Bottom : 739,282 s.m
Proposed ILAG WASTE DUMP
Volume Capacity: 51M Tons
Area Top Elev @285m: 283,075 s.m
Area Bottom: 668,615 s.m

Fig.1. 13. **Airstrip Site-Ilag WRD Expanded Area (Amended ECC)**

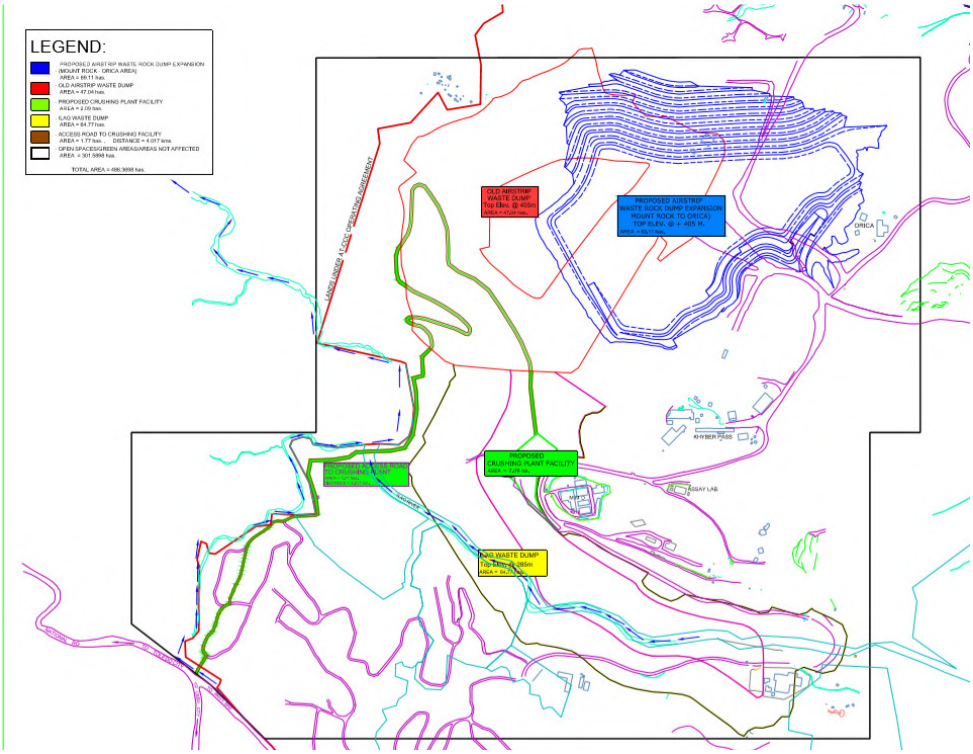


Figure 1. 14 Site Development Plan for Proposed Airstrip WRD 2nd ECC Amendment

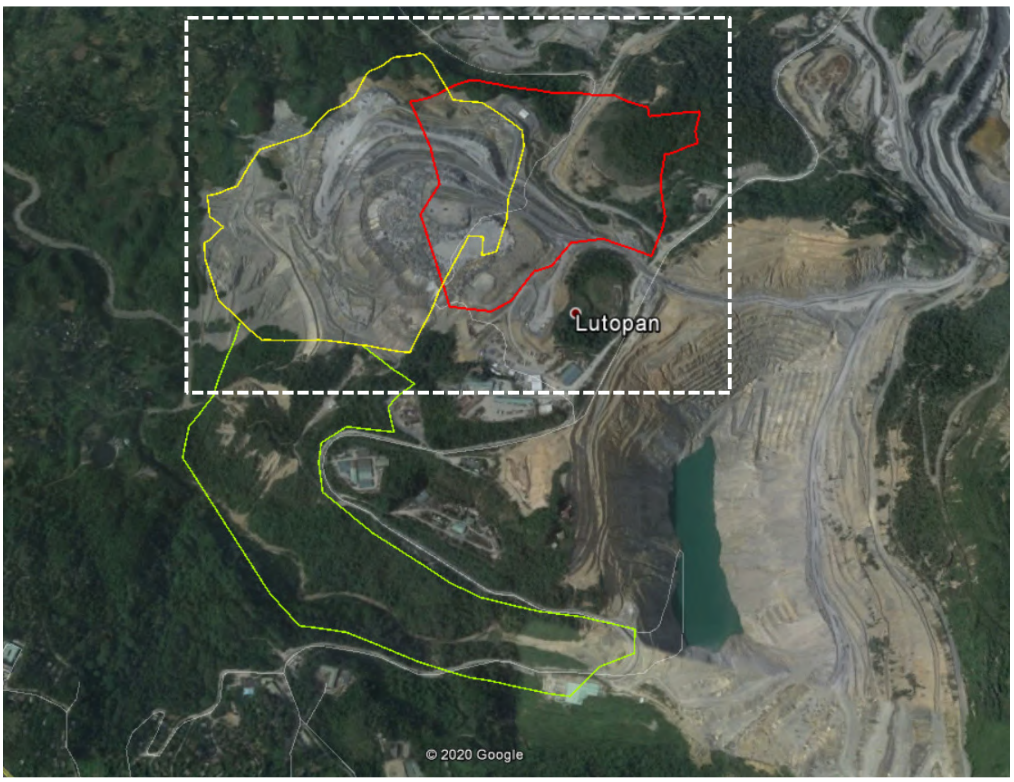


Figure1. 15 Overlay of the Airstrip-Ilag WRD ECC covered areas and the Proposed Amendment

1.2.6.2.4.2 Marcona WRD

The Marcona occupies a land area of 69.08 hectares with a capacity of 92M tonnes. Rock waste dump with an elevation of 540 meters having a top area of 41.177 hectares, and a bottom area of 6.0168 hectares. The proposed Marcona Waste Rock Dumpsite is designed to accommodate the waste striped/mine from the Carmen Pit.

1.2.6.2.4.3 Closed WRD

A number of old, abandoned and closed WRDs distributed around the Toledo Copper Mines site has been subjected for rehabilitation and tree plantation.

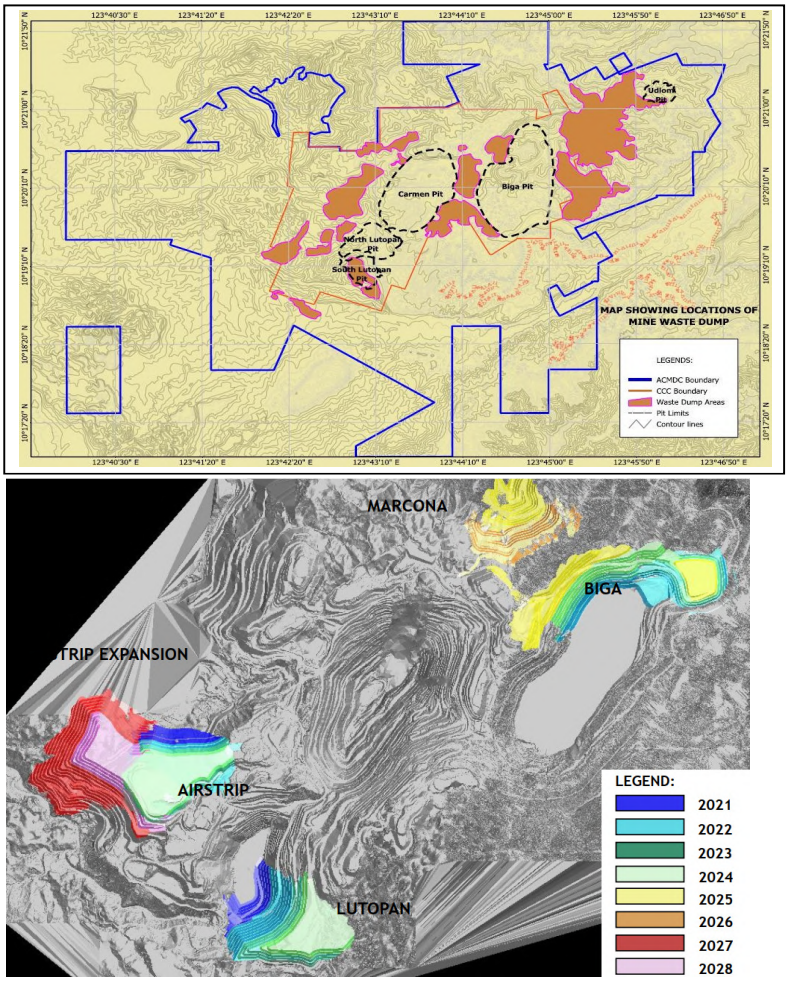


Figure 1.16 Location of Waste Rock Dumps. Old & New WRDs (above), WRDs with recent and future Expansion Plans

1.2.6.2.5 Port Facility

The Port Facility, operated by ACMDC since 1955 is located in Brgy Daanlungsod within the urban district of the City of Toledo. The port facility, which primarily handles copper concentrates from the mine site's Carcon facility (about 14 kilometers distant), for transport and delivery to various clients/buyers destinations.

The port facility includes the following components (utilities/infrastructures)

- Pier. Concrete and steel structure of 188.48 meters in length, supported by concrete piles.
- Copper concentrate Bin. A concrete and steel structure/warehouse having a storage capacity of 15,000 tons of copper concentrates
- Magnetite Concentrate Bin. A steel structure with a holding/storage capacity of 60,000 tons of magnetite concentrates
- 750KVA Power Substation. A concrete one-storey building having a floor area of approximately 72 sq.mtrs. Primary function is to provide power to the conveying system and support facilities of the Port
- Port Security Detachment. A concrete building of 24 sq.mtrs
- Causeway. Concrete structure of approx.. 20 sq.mtrs. for barging or RoRo operations on light cargo transit
- Fire Hydrant system
- Scale house. A 60-ton capacity truck scale to weigh copper and magnetite concentrates
- Other improvements: Terminal Office Building (84 s.m), Fabrication shop (74 s.m), Buffer Store/Warehouse, Communication tower, and Diesel Fuel Station (composed of two 15,000 liters capacity cylindrical storage tanks and a dispensing pump)

Table 1.19 Port Facility/Equipment and Capacities

Equipment	Capacity
1-unit Conveyor System	2000.0 WMTD
3-units Concentrate bins	18000.0 WMT/mo.
4-units Memmert Oven	1500.0 grams/day
1-unit Triton Splitter	1500.0 grams/day
1-unit Essa 3D Digital (test sieve)	1500.0 grams/day
1-unit Impulse Sealer	1500.0 grams/day

1.2.6.2.6 Housing, Health, and Recreational Facilities

CCC provides housing accommodation to both married and single managerial employees established based on Company policy, house availability and is subject to management's evaluation and approval. Operations and technical employees are accorded first priority due to work exigencies.

Qualified employees who signify to stay inside the mine camp are accommodated at dormitories while for qualified married employees who wish to bring their families, they are billeted in staff houses. Sleeping quarters are also available to all rank & file employees who wish to stay overnight inside the mine camp when they find it hard to go home due to transportation constraints.

Eligible employees who are not provided with housing accommodation receive a housing cash assistance in lieu of their housing privilege.

Aside from the accommodations, CCC has facilities for health, leisure and sports. There is a 3-story, 15-bed capacity hospital (PhilHealth accredited Level 1 hospital) with functional operating rooms and delivery rooms, secondary clinical laboratory, drug testing facility, Radiology section, Pharmacy and TB DOTS clinic. For leisure, the Company offers a swimming pool, a social hall and bar/restaurant. In addition, the Company had opened a Heritage Center that imparts all the significant facts and history of the mine. The Company also upholds employees' sports interest and promotes work life balance by providing sport facilities such as fitness gym, darts, billiards, basketball courts, volleyball court, lawn tennis courts, table tennis and badminton courts. These facilities cater not just the employees but their dependents as well. Communities are also welcome upon request.

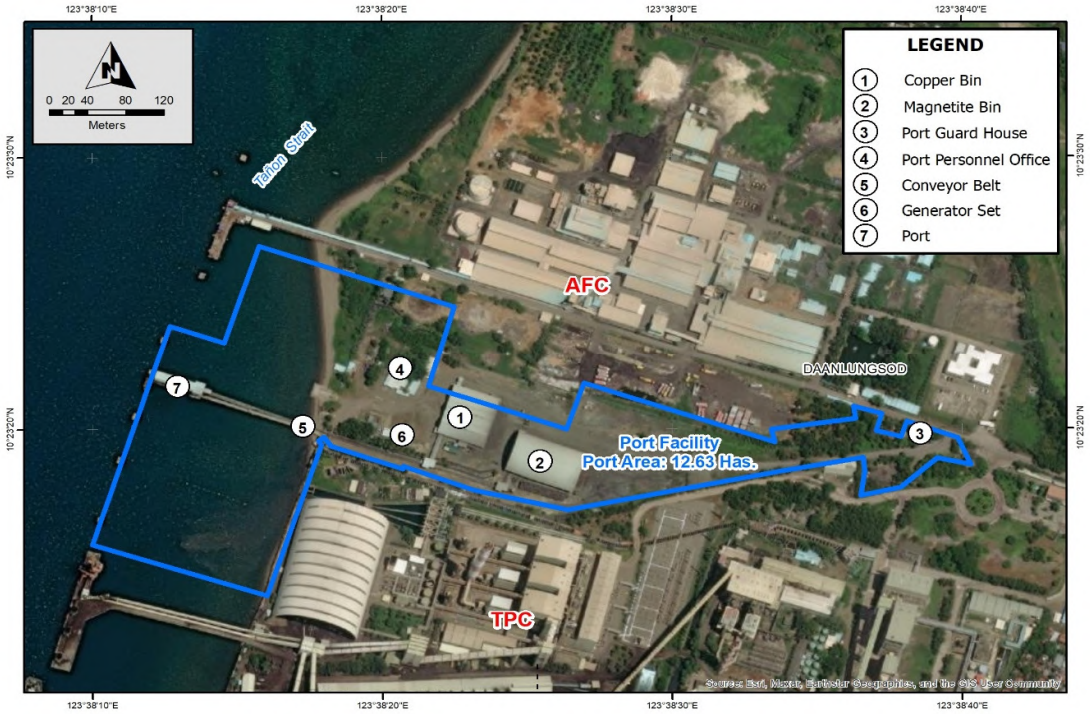


Figure 1. 17 Port Facility Site Development Layout

Figure 1.18. Various Site and Facilities Photographs

Photo 1.18a Lutopan Pit and Lutopan Masaba WRD

Figure 1.18b Biga Pit

Photo 1.18c Tailings Thickener

Photo 1.18.d Emergency Tailings Pond

Photos 1.18e Left-Right Stage 1 to Stage 3 Pump House

Photo 1.18f Airstrip Site WRD

Photo 1.18g Udlom Settling Pond

Photo 1.18h Sigpit Silting Pond

Photo 1.18i Abaca Water Treatment Plant

Photo 1.18j Shop (left) and MMD Warehouse (Right)

Photo 1.18.k Administration Building

Photo 1.18.l Museum and Staff Clubhouse (Left), Recreation & Gym Facilities (Right)

Photo 1.18m. Hospital

Photo 1.18n Ecopark

Photo 1.18o CCC Port

1.2.7 Process Technology

1.2.7.1 Mining Operations

1.2.7.1.1 General Mining Process

The mining process for metal extraction usually consists of two parts: mining and milling. The mining component is the extraction of metal-bearing ore from rock. The milling component generally crushes, grinds and extracts a concentrate in a series of mechanical and/or chemical processes.

Mining involves the extraction of unwanted non-metal-loaded rock in order to reach the ore. The Carmen Copper (Atlas) Mines has a number of Wastes Rock Dumps disposal facilities. Milling produces finely ground waste from which the metal concentrates has been separated. This waste is called tailings, and are disposed in the Biga Pit Tailings Storage Facility. **The WRDs and the TSF were respectively issued ECCs.**

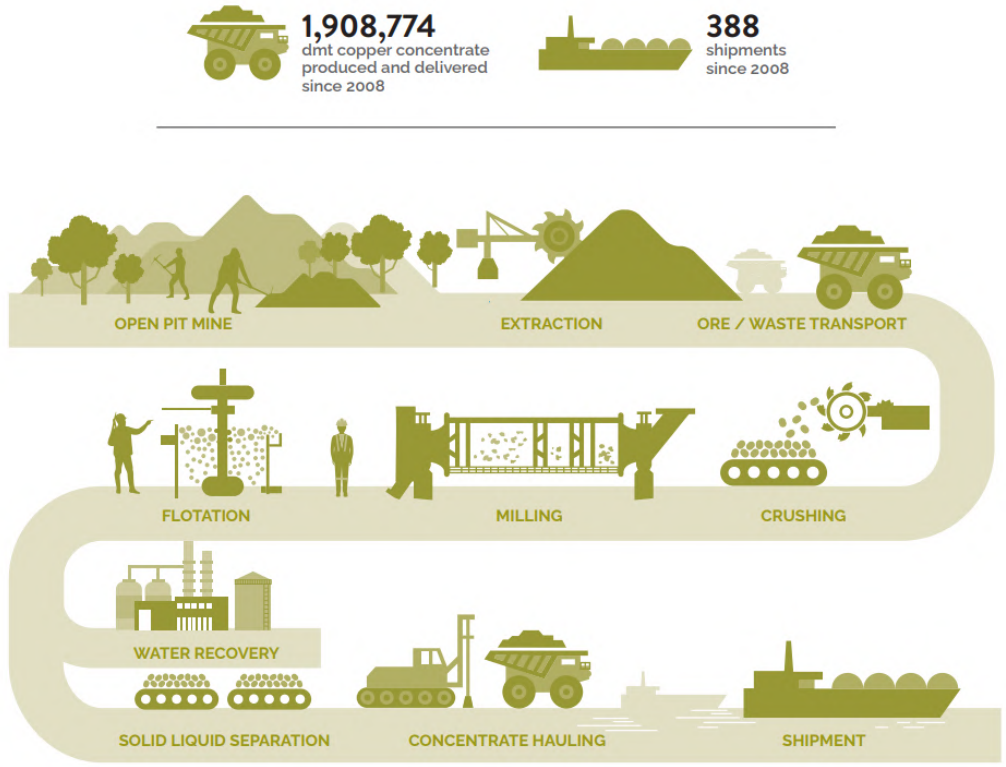


Figure 1.19 Mine to Port Operations Schematic Diagram

Mining Methods

In the initial feasibility study, for the revived operations, the Carmen orebody willbe mined by open-cast and later by underground method. With this, the inactive Carmen Pit and its extended Carmen Underground (CUG) Lift-1 workings are being dewatered, cleared of muck and rehabilitated.

Pending the rehabilitation of Carmen Pit/Carmen Underground, however, copper mine production started with an initial MTPD of 20,000 in the last quarter of 2008 with ore produced from the South Lutopan Pit. By 2010, mining of North Lutopan Pit is expected to commence.

Block-caving extraction method[7]**.** The Carmen underground ore will be mined by full-gravity block caving method. The system has long been practiced and is well established at the Atlas copper operations and, as such, the Atlas underground personnel are regarded asexperienced and technically capable with the system.

Block caving involves the development of the haulage, grizzly and undercut levels, and transfer and draw raises that connect the three levels. The caving of the block is initiated by blasting a 6-meter slice of the ore column at the undercut level. After the pillar is removed, the ore column becomes

[7] Resumption of Underground Mining has not been included in present and immediate future plans

unstable and starts to cave or fall by gravity. The broken ore is then drawn at controlled rates through the draw points and transferred to the haulage level through transfer raises

The ore from the transfer raises will be collected by 15-ton capacity bottomdump cars. The loaded cars are in turn pulled by a 20-ton locomotive and the ore is dumped into two ore passes that are connected to two underground gyratory crushers. Finally, the crushed ore is transported to the surface via a decline tunnel conveyor having a design capacity of 2,100 tons per hour.

The Carmen underground orebody is divided into 16 panels, all of which have a uniform width of 59 meters. The lengths are between 120 and 310 meters with the midsection panels measuring longer. The heights of these panels vary between 160 and 330 meters, and the lowest of which are the southern panels located directly below the base of the open pit.

Open cast method. Basically, the first stage in any open pit mining is designing the pit plans basedon the ore reserve blocked-out by mapping, outcrop sampling and diamond drilling.

Actual open pit mining operations consist of stripping the overburden until theore is exposed, and then the following sequence of events is undertaken:

- Rotary drill-hole stakes are established at the top bench based on drill pattern prepared by pit planning engineers.
- Blast holes are drilled using electric rotary drills at 18-meter depth including the three meter sub-grade to ensure good fragmentation and eliminate hard toes.
- Sample cuttings are taken from every drill hole for laboratory analysis.
- The blasting crew will load the holes with explosives, and blast.
- Boundary contact between ore and waste is delineated after blasting suingthe ore situation map.
- PC1600SP Komatsu Backhoe loads the materials to the haul trucks; and
- The haul trucks transport the ore to the Carmen Concentrator's Primary Crusher, and the waste rocks to the underground subsidence area as backfilling materials.

All haul roads and ramps have minimum widths of 30 meters and the a minimum curve radius of 70 meters to accommodate double passage of the existing 170-tonne hauling trucks. Maximum grade for the ramps is 8% while working berms have a gradient of 0.5% to 1.0% for drainage purposes. Tabulated below is the Mine Open Pit Design Parameters.

Table 1.20 Mine Open Pit Design Parameters

Parameters	Value	
	South Carmen Pit	South and North Lutopan Pit
Back/Overall Slope: In-Situ Fill	50°	45° 35°
Gypsiferrus Zone (75%)	52°	
Non- Gypsiferrus Zone (25%)	45°	
Bank/Bench Slope: In-Situ Fill	65°	65° 49°
Mining Bench Height	15 meters	15 meters
Final Bench Height	30 meters (double benching with pre-split holes)	
Bench/Berm Width	14 meters	8 meters
Minimum haul Road width	30 meters	30 meters
Minimum road curve radius	70 meters	70 meters
Maximum ramp gradient	8%	8%
Drainage gradient	0.5-1.0%	0.5-1.0%

The present pit drilling equipment at the mines consists of two (2) D55SP engine-driven Tamrock Drills. These are large diameter rotary drills intended for drilling blast holesusing a 10.0-inch diameter tricone tungsten carbide drill bit. The Tamrock drill during its peak performance registered an average output of 400 meter or more than 20 blast holes per day.

Drilling pattern and spacing for blast holes varies from six meters by eight meters for hard formation, where good fragmentation is required. Up to eight meters by eleven meters for softer formations where only toe breaking is required. Blast holes are usually drilled to an 18-meter depth, including the three-meter sub-grade, to ensure good fragmentation and eliminate hard toes. Drill cuttings in each blast hole will be collected down to 15 meters depth for assaying of copper values for grade control purposes.

Explosives commonly used, as charges are ANFO and cartridge of primer and detonator. For totally dry holes, ANFO is poured directly from the ANFO mixing truck into the holes after the down and trunk lines are laid together with the primers and detonating fuses.All downlines are double to safeguard against costly and dangerous misfires. In the case of watery holes, the water is pumped out first using a submersible pump before the ANFO, bagged in polyethylene tubes is loaded into the blast hole. For holes with high water seepage, either deck loading is applied, with slurry as bottom loads and bagged ANFO at top loads, or all slurry loads is applied.

1.2.7.1.2 Carmen Concentrator/Copper Ore Processing Facility

The run-of-mine ore from Carmen Pit is being delivered by 100-tonner dump trucks to the Carmen Concentrator for processing.

Stages of Ore Processing are the following:

a. **Crushing.** Ore delivery from the mine is dumped to primary crushers Line 1 (Gyratory Crusher) and Line 2 (Jaw Crusher). The crushed ore will then be stocked in the Coarse Ore Stockpile (COS) having a capacity of 120,000 metric tons. Ore is drawn from the COS to undergo secondary and tertiary crushing. Secondary and tertiary crusher product is then transported to the screening plant for size separation. The screening plant undersize together with the primary screen undersize will be distributed to the Fine Ore Bin having a live capacity of 90,000 metric tons.

b. **Ore Sorting.** In the Ore Sorting Plant, low grade ore will be delivered and crushed to -50mm for sorting and the product ore crushed to -10mm will be directly conveyed to Fine Ore Bin (FOB). Magnetic Resonance Analyzers (MRA) will be used in ore processing which rapidly identifies ore grade so that large volume of waste rock (gangue) can be rejected. The plant will be based on an initial throughput of 1,000 tons per hour and an output of 400 tons per hour upgraded ore of 0.35%Cu grade but could be adjusted based on plant requirements.

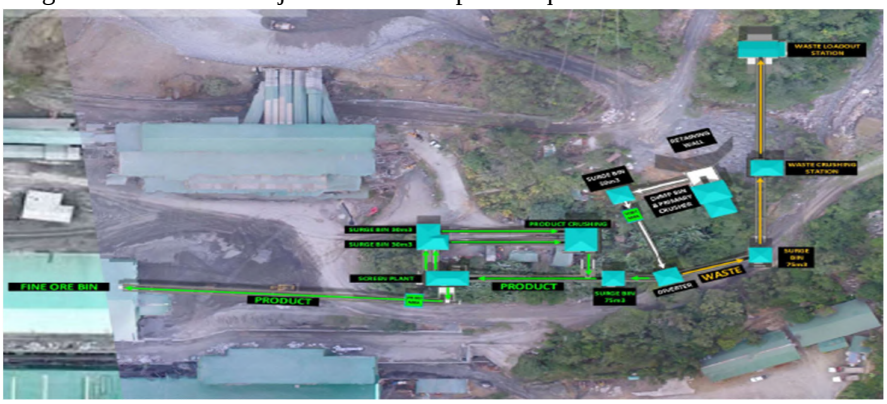


Figure 1.20 Ore Sorting Site Location

c. Grinding. After the ore had been reduced to size minus 0.5 inch in three-stage crushing, it is then subjected to two-stage wet grinding. The primary ball mills can be operated three (3) configurations: hybrid circuit, closed circuit via transfer tank and closed circuit via Wemco scavengers. The cyclone overflow of each configuration will report to its respective next stage while the cyclone underflow will return to the ball mill as circulating load.

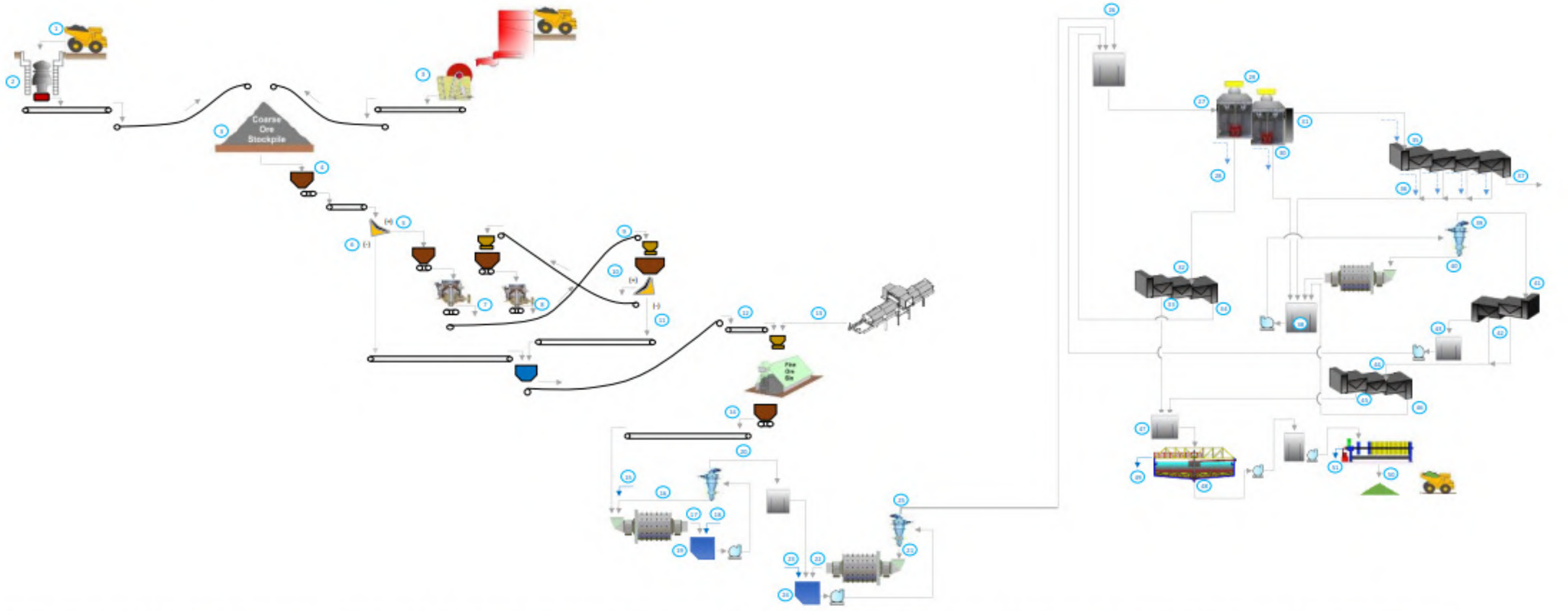
The cyclone overflow of hybrid circuit mills will flow to the open launder towards the hybrid splitter box. The slurry is fed to the secondary mills sump box which is pumped to the hydrocyclones. The secondary cyclone overflow will pass through a trash screen and will flow to the open launder towards the tank cell splitter box. The secondary cyclone underflow will feed the secondary ball mills for further size reduction. In closed circuit configuration via transfer tank, the overflow of mills will flow to the open launder towards the transfer tank and is then pumped to pass through the trash screen and will flow to the open launder towards the tank cell splitter box. Meanwhile, for closed circuit configuration via Wemco, the overflow of the mills goes directly to the scavenger flotation cells (Wemco 500).

d. Flotation. The flotation circuit is composed of multiple stages of roughing, scavenging and cleaning to produce a copper concentrate grade of 26.5% Cu and a final tails grade of less than 0.040% Cu.

The primary collector is added in hybrid splitter box while pH modifier is added in primary ball mills to allow sufficient conditioning contact with the freshly created surfaces of the ore. Secondary collector and frother are also added in roughing and scavenging stage. The concentrate of the flotation goes to the final concentrate thickener for dewatering from 30% solids to 65% solids thickener underflow. Similarly, the tailings of the flotation would undergo dewatering for water recovery and solids impoundment.

e. Dewatering. The final copper concentrate from the 3rd cleaner will undergo a series of dewatering processes such as thickening and filtration. The thickened slurry at 65% solids will be pumped to the filter feed tank and is fed to the filter press and drum filter to produce a filter cake with transportable moisture of 9.5% to be delivered to Sangi Port for shipment.

f. Tailings Thickener. The final tailings from the flotation circuit are transported by gravity and distributed to one (1) high rate thickener and six (6) conventional thickeners for disposal and water recovery. Flocculants are added to speed up settling of solids. The thickened slurry will be pumped for delivery to Biga Tailings Storage Facility. The impounded residual water from tailings outflow and storm run-offs from the surrounding catchments inflowing to the pond will be allowed to accumulate in the pond in sufficient quantity to be pumped back to Carcon water head tanks for recycling to the milling circuit.



Stream No.	1	2	3	3	4	5	6	7	8	9	10	11	12	13
Stream Name	ROM Feed	Gyratory Crusher Discharge	Jaw Crusher Discharge	Primary Crusher Final Product	STC Feed	Primary Screen Oversize	Primary Screen Undersize	Secondary Crusher Discharge	Tertiary Crusher Discharge	Combined Secondary-Tertiary Crusher Discharge	Secondary Screen Oversize	Secondary Screen Undersize	STC Final Product	Ore Sorter
Solid, tph	2,293	1,876	417	2,293	2,293	1,708	585	1,708	1,926	3,634	1,926	1,708	2,293	208
Cut-off size	17.72"	6.00"	6.00"	6.00"	6.00"	6.00"	1/2"	1 1/2"	1/2"		1 1/2"	1/2"	1/2"	1/2"
% Passing cut-off size	100.0	80.0		80.0	80.0	80.0	90.0	80.0	80.0		80.0	90.0	90.0	90.0

Stream No.	14	15	16	17	18	19	20	21	22	23	24	25
Stream Name	Primary Ball Mill Feed (1-7)	Primary Ball Mill Feed Dilution Water	Cyclone Underflow	Primary Ball Mill Discharge	Ball Mill Discharge Dilution Water	Primary Cyclone Feed	Cyclone Overflow	Secondary Cyclone Underflow	Secondary Ball Mill Discharge	Secondary Ball Mill Discharge Dilution Water	Secondary Cyclone Feed	Secondary Cyclone Overflow
Solid, tph	2,264		10,188	12,452		12,452	2,264	5,943	5,943		8,207	2,264
Water, tph	45	1,329	3,962	5,337	1,078	6,415	2,453	2,547	2,547	2,323	5,943	3,396
Slurry, tph	2,309		14,150	17,789		18,867	4,717	8,490	8,490		14,150	5,660
Solid, m3/hr	845		3,801	4,646		4,646	845	2,218	2,218		3,062	845
Water, m3/hr	45	1,329	3,962	5,337	1,078	6,415	2,453	2,547	2,547	2,323	5,943	3,396
Slurry, m3/hr	890		7,763	9,983		11,061	3,297	4,765	4,765		9,005	4,241
Solid SG	2.68		2.68	2.68		2.68	2.68	2.68	2.68		2.68	2.68
% Solids	98.0		72.0	70.0		66.0	48.0	70.0	70.0		58.0	40.0

Stream No.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Stream Name	Rougher Feed	Rougher 1 Feed	Rougher 1 Conc.	Rougher 1 Tails/Rougher 2 Feed	Rougher 2 Conc	Rougher 2 Tails	High Grade Clr Feed	High Grade Clr Conc	High Grade Clr Tails	Scavenger Feed	Scavenger Concentrate	Scavenger Tails	RBM Cyclone Feed	RBM Overflow	RBM Cyclone Underflow	Insol Clr Feed	Insol Clr Conc	Insol Clr Tails	Low Grade Clr Feed	Low Grade Cleaner Conc	Low Grade Clr Tails	Thickener Feed	Thickener Underflow	Thickener Overflow	Filter Feed	Copper Conc.	Filtrate
Solid, tph	2,264	2,303	34	2,269	11	2,258	34	15	19	2,258	28	2,230	51	34	16	34	14	20	14	2	12	17	17	-	17	17	-
Water, tph	3,396	3,653	91	3,561	30	3,531	155	38	118	3,632	48	3,584	313	275	38	275	100	175	120	15	104	53	7	45	7	2	6
Slurry, tph	5,660	5,956	125	5,830	41	5,790	189	53	136	5,891	76	5,815	363	309	54	309	115	195	134	18	116	70	25	45	25	19	7
Solid, m3/hr	845	852	10	840	3	836	10	4	6	836	9	858	23	16	7	16	4	7	4	1	4	5	5	-	5	5	-
Water, m3/hr	3,396	3,653	91	3,561	30	3,531	155	38	118	3,632	48	3,584	313	275	38	275	100	175	120	15	104	53	7	45	7	2	7
Slurry, m3/hr	4,241	4,505	101	4,402	33	4,368	165	42	124	4,469	57	4,442	336	291	45	291	104	182	124	16	108	58	12	45	12	7	7
Solid SG	2.68	1,322	1,237	1,325	1,222	1,326	1,145	1,256	1,103	1,318	1,332	1,309	1,081	1,064	1,193	1,064	1,100	1,071	1,085	1,103	1,078	3.51	3.51	-	3.51	3.51	-
% Solids	40.0	39	27	39	26	39	18	29	14	38	37	38	14	11	30	11	12	10	11	13	10	24.7	70.0	-	70.0	91.5	-

Figure 1.21. *Carmen Concentrator – Copper Processing Circuit (Material Balance)*

FIGURE 1.22. VARIOUS CARCON FACILITIES SITE PHOTOS

Figure 1.22a Aerial View of the Carcon Facility

Figure 1.122b Photographs of Primary Crusher

Figure 1.22c Photographs of Secondary and Tertiary Crusher

Figure 1.22d Photographs of Fine Ore Bin

Figure 1.22e Photographs of Ball Mill

Figure 1.22f Photographs of Flotation Facility

Figure 1.22g Photograph of Filtration Process utilizing two rotary drum filters to remove water from the copper concentrate feed. The concentrate piles below the filter elevation represent the final product of the CCC copper processing facility

Figure 1.22h. Photographs of Tailings Thickener

1.2.7.1.3 WRD Operations. Operations of the waste rock dump, generally involves the following activities (Oraee et al)

- Waste transports from the mine to the dump.
- Off-loading of the waste at the dump in accordance with the planned dump development and operating plans, including lift height and location.
- Access road construction and maintenance.
- Clearing of new areas for dumping, foundation preparation and drain construction as required in new areas.
- Maintenance, upgrade and expansion of surface water management facilities.
- Environmental monitoring of conditions at the dump including seepage water, surface water, groundwater quantities and quality.
- Dump performance monitoring and documentation including stability, erosion, consolidation and creep.

1.2.7.2 Power

For 2020 and onwards the power consumption is expected to rise to about 49 Megawatt (MW) when the mine production is at 50k TPD.

Electricity will be provided either by the existing Toledo Power Company at Sangi, Toledo City, Wholesale Electricity Spot Market or any other reliable power providers.

Presently, CCC's power supply is primarily provided by Toledo Power Company (TPC) based on Contract of Energy Conversion Agreement (ECA). This is being generated from its Sangi Thermal Power Plant at Sangi, Toledo City. About two percent (2%) comes from Cebu Electric Cooperative (CEBECO III) and eleven percent (11%) comes from the Wholesale Electricity Spot Market (WESM) power. The CCC 2 x 5 MW diesel plant is there for back-up and emergency use only. CCC's power system is also directly connected to the Cebu-Negros-Panay (CNP) power grid and is drawing an amount of power as necessary or when WESM power is cheaper than its contracted power from TPC.

CCC has a double circuit loop power transmission facility from TPC in Sangi, Toledo City to CCC's mine site. Hence, CCC has the flexibility and guaranteed stable power supply.

Table 1.21 Power Consumption, 2021

Month	CCC Consump-Tion	Power Demand (KWH)	Milling Tonnage (KTPD) Budget 2020	Mill Production (KTPD)	KWH/ TON	CEB3 kWh
Jan-21	33,673,030	45,259	49,667	40,586	26.76	170,596.74
Feb-21	31,203,940	46,434	51,405	46,462	23.99	101,548.82
Mar-21	36,641,830	49,250	54,153	53,014	22.30	34,165.12
Apr-21	37,246,110	51,731	53,466	54,501	22.78	112,987.02
May-21	38,600,890	51,883	52,234	55,465	22.45	15,213.76
Jun-21	37,482,810	52,059	49,845	53,576	23.32	119,584.60
Jul-21	38,990,682	52,407	50,436	54,904	22.91	22,243.56
Aug-21	39,075,652	52,521	50,678	51,513	24.47	31,067.12
Sep-21	38,010,234	52,792	48,043	53,844	23.53	131,136.58
Oct-21	37,958,832	51,020	48,227	49,395	24.79	25,163.74
Nov-21	37,292,161	51,795	50,699	53,345	23.30	72,864.42
Dec-21	22,645,804	30,438	48,634	29,415	24.83	98,491.04
	428,821,975.00	48,952.28	50,624	49,668.23	23.50	935,062.54

Table 1.22 Power Supply Sources, 2021

Power Sources	Kwh	Cost	Average/kWh
TPC	406,829,729	2,209,200,078	5.4303
WESM	21,867,190	137,346,320	6.2809
CCC DIESEL	71,261	583,394	8.1867
CARMEN DIESEL	53,795	656,181	12.1978
TOTAL	428,821,975	2,347,785,971	5.4750

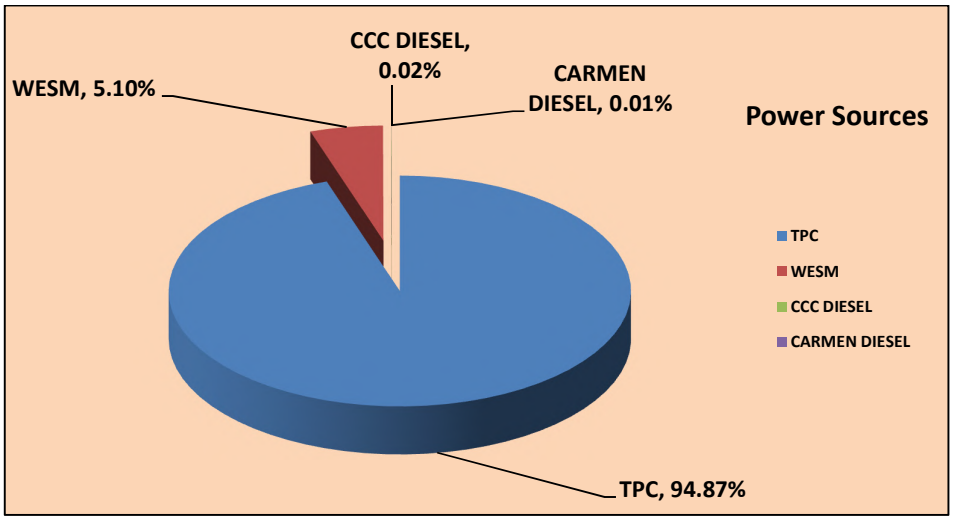


Figure 1.23 Share of Power Supply Providers

1.2.7.3 Water Supply and Water Resource/Pollution Management

Mine Water Supply

The major water supply of Atlas comes from the Malubog Dam and Reservoir which was established in 1971. It is situated some three (3) km. north of the Carmen concentrator or 12 km. of Barangay DAS. The reservoir consists of a man-made lake with an original pondage of about 5.4 billion gallons and a concrete dam across a gorge on the south that was once the natural drainage outlet. The entire reservoir has a potential watershed of about 7,000 ha. The dam overflow gravitates downstream to a smaller reservoir called the Sigpit Dam. Based on the WRC water study the estimated water volume capacity of Malubog is 88,000 cu./day

The Malubog Dam was designed with a safety factor of 2.0 against sliding and a factor of 1.5 against overturning from an earthquake load with 0.2 "*g*" acceleration. The structural resistance of the limestone gorge provides additional strength to the dam.

The previous total water demand from the Malubog Reservoir was about 58.67 cu.m/min distributed into 54.89 cu.m/min for industrial use and 3.79 cu.m/min for domestic household consumption inside the mine camp and outside in Barangay DAS. Two 3-km. main pipelines deliver this supply to the receiving sump at Abaca and to Carcon head tanks.

The present domestic water requirements still draw its supply from the Abaca sump that initially feed the raw stock to the nearby Water Treatment Plant for filtration and chlorination. The treated water is then stored to a 2,839.06 cu.m head tank before it is distributed to six smaller holding tanks strategically placed around the mine site.

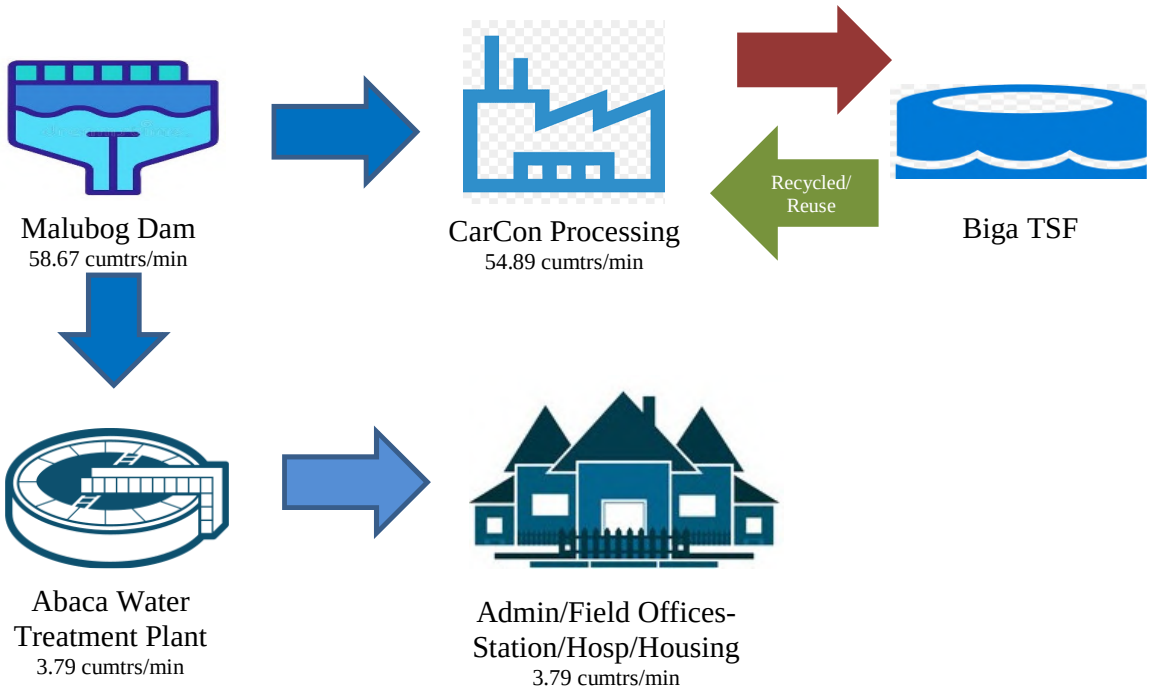


Figure 1.24 Water Balance Schematic Diagram

Acid Mine Drainage

By the nature and character of the CCC ore bodies which contain substantial amount of sulphide-rich rocks, mining and processing them have inevitably produced and will continue to generate above-normal levels of acid mine drainage (AMD). AMD are primarily produced as low-pH residuals from the exposed sulphide deposits, underground workings, open pit operations, and waste dumps, and secondarily from road cuts, stockpiles and mill drainage runoffs.

Specifically, the sources of the CCC AMD are identified in the following areas:

a) Carmen pit, which drainage outflow discharges to the Sigpit Biga Drain Tunnel (SBDT) and thence to the Sigpit Creek;
b) Waste dumps around the Lutopan catchments that drain to the Ilag River;
c) Waste dumps west of the Carmen pit draining to the Sigpit-Hinulawan River;
d) Waste dumps north and east of the Biga pit that draining to the Malubog Reservoir.

Drainage System. The CCC mine complex is served by three major drainage systems namely: Cumba-Guinquiotan River at the north; Sigpit-Hinulawan River at the central portion; and Ilag River at the south. All these drainage systems eventually join the Sapang-Daku River that drains out towards Cebu's West Coast and to the Tañon Strait. A mountain range located east of the Atlas mine complex act as a divide that inhibits the flow of runoff water to the East Coast of Cebu.

AMD Control Measures. CCC always conscious of its responsibility to protect the environment, has put in place and will continue to maintain a system to check acid mine drainage generation. It has always

been the company's policy that all effluents flowing out of the mine complex must be within the standards prescribed by government regulations.

The AMD control strategies will consist of the following measures:

a) Backfilling of pit voids, such as in the proposed deposition and encapsulation of mill tailings at Biga pit;
b) pH control by dilution and chemical amendments to enhance mine drainage alkalinity and depress copper values;
c) Water control by local drainage flow diversion and surface re-contouring;
d) Re-vegetation and afforestation of mine-disturbed pits and waste dumps to slow down oxidation of sulphide ores.

Water Dilution to Control pH Level. At Sigpit-Hinulawan River junction, the Sigpit Dam was constructed to serve as a secondary water reservoir, silt trap and monitoring point of effluents coming from the central portion of the mine complex. The dam is covered by Water Permit No. 1162 for industrial use. Aside from the rivers that merge into the dam, water from the Sigpit-Biga Drain Tunnel (SBDT) also flows into the reservoir.

The pH levels of the water from the Sigpit tributary and likewise from the Hinulawan River are always slightly basic (7.0 to 8.0) principally because their headwaters are within the limestone formation.

Tailings Impoundment at Biga Pit. Biga Tailings Storage facility is continuously utilized as a containment pond. The encapsulation of mill waste that will eventually prevent oxidation of sulphide minerals exposed at the pit and in effect reduce, if not eliminate, generation of AMD therein. Further, the tailings mass is highly basic (pH = 10 to 11) in composition and therefore a potent depressant for neutralizing acid formation.

Chemical Amendments to Control pH Level. A slaked lime set-up facility which has been in operation since August 1999 shall be maintained at the SBDT outlet to ensure and control that the quality of water being discharged is within the DENR standard.

A proposed Biga Settling Pond Lime Slaking Facility at Biga 12-Chamber Settling pond shall be constructed to counteract the effects of Acid Mine Drainage on the pH of the effluent water released from the settling pond, to maintain compliance to environmental standards and minimize the impact of mining on surrounding bodies of water.

Water Diversion and Surface Re-Contouring. Storm runoffs and subsurface water in Carmen and Biga pits presently flowing and seeping into predominantly pyritic zones will be redirected to limestone beds or areas with low-sulphide characteristics. Additionally, combined reshaping and re-contouring of pit and dump surfaces also divert water inflow away from sulphide-rich areas. These techniques helps reduced volume loading of AMD from the surrounding waste dumps into the two pits.

Re-vegetation of AMD-Source Areas. To finally augment and enhance capping and other measures mentioned above, inactive pit walls and waste dumps slopes were planted with well adapted trees and shrubs as a special component of the overall company-wide greening program. indemic

1.2.7.4 Pollution Control and Waste Management

The operations of the Toledo Copper Mines generated two major waste streams – waste rock from its surface mining activities and tailings from ore processing. A number of Waste Rock Dumps (WRD) can be found in various locations of the minesite, these consists of old WRDs not anymore utilized and those currently being used. The old WRDs were rehabilitated and reforested, while the operational WRDs are managed by providing appropriate benching, drainageways, siltation ponds

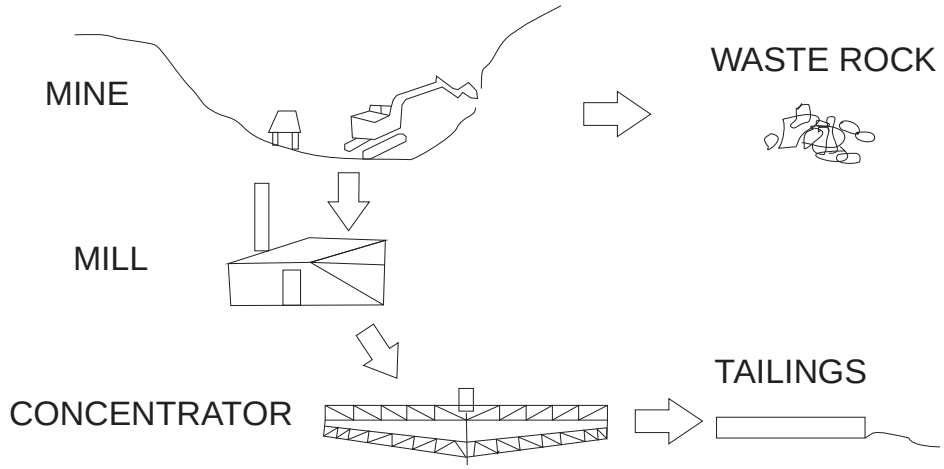


*Figure. **1.25*** **Mining and Milling Wastes Production Schema**

Table 1.23 Pollution Control Measures

Activity/Area	Aspect/Impact	Control/Management Measures
• Heavy equipment shops and points of operation • Waste Dumps (near adjacent communities) • Crushers and ball mill sections • Off-highway truck operations • Tractor and loader operations • Open pit areas blasting/drilling	***Noise/Nuisance****- Heavy Equipment & Mine Machinery operations- earthmoving, blasting, drilling*	• CCC will adopt, as in procurement practices, proper equipment and process selection [buy units and utilize methods with low noise-generating specifications; • It will implement, as a matter of sound management, regular equipment servicing and maintenance [timely parts replacement or repair], frequent lubrication, bolt tightening, etc.; • Use of mufflers, insulation, dampers, baffles or sound-proofing will be availed of in noise-critical operations; • It will provide enclosures, cabs or barriers to isolate operators in noisy areas; • Avoid overloading of explosives on blast holes; • It will promote job rotation or reduced work duration; • It will implement and enforce the use of ear protection devices [ear inserts or muffs].
Power plant, mobile eqpt, lime, kiln, generators, laboratory operations, and concentration process: • Open Pit (dry haulroads, rockdrill sites,blasting areas, etc • Concentrator facility (stockpiles, fine ore bin, screening plant, crushers, etc. • Plans/Shops (aggregate plant, lime plant crusher/bin,	*Air Quality-dusts, mine gases, blasting fumes, exhaust-emissions*	• CCC continues to comply with all applicable regulations and standards prescribed by the Philippine Clean Air Act (R.A. 8749). • *Installed* dust suppression methods especially wetting of stockpiles, blasting faces, ore bins, ore passes, loading stations, haul roads, ore trains, and similar dust-critical areas. • Use of dust collectors. • Controlled blasting to minimize dust and fumes. • Provision of enclosures and/or isolation barriers for operators. • Use of local-exhaust ventilation system. Good industrial gas storage practice. • Use of personal respiratory protective equipment • Conduct regular air quality monitoring on identified critical areas.

Abstraction/extraction of water for minesite domestic/industrial-processing utilization from Malubog Dam.	Depletion, degradation of water supply source	• CCC complies all applicable regulations and standards prescribed under DENR DAO Nos. 34 and 35. • CCC continues to adopt water conservation as a company policy and practice both in industrial and domestic fronts. It will optimize used-water recovery and recycling in milling operation. • Conduct regular inspection, repair and maintenance of Malubog Dam, pipelines, sumps, holding and head tanks, treatment plant. • Periodic water sampling subject for analysis
Generation of AMDs from mining & processing of ore bodies containing substantial amount of sulphide-rich rocks; sources of AMDs within the minesite: • Carmen pit, which drainage outflow discharges to the Sigpit Biga Drain Tunnel (SBDT) and thence to the Sigpit Creek; • Waste dumps around the Lutopan catchments that drain to the Ilag River; • Waste dumps west of the Carmen pit draining to the Sigpit-Hinulawan River; • Waste dumps north and east of the Biga pit that draining to the Malubog Reservoir	*Acid Mine Drainage (AMD)*	• *Water Dilution to Control pH Level. T*he Sigpit Dam (Sigpit-Hinulawan Rivers junction) served as a secondary water reservoir, silt trap and monitoring point of effluents coming from the central portion of the mine complex. Aside from the rivers that merge into the dam, water from the Sigpit-Biga Drain Tunnel (SBDT) also flows into the reservoir. The pH levels of the water from the Sigpit tributary and likewise from the Hinulawan River are always slightly basic (7.0 to 8.0) principally because their headwaters are within the limestone formation • *Tailings Impoundment at Biga Pit* • *Settling ponds* • *Chemical Amendments to Control pH Level.* A slaked lime set-up facility which has been in operation since August 1999 shall be maintained at the SBDT outlet to ensure and control that the quality of water being discharged is within the DENR standard • *Water Diversion and Surface Re-Contouring* • *Re-vegetation of AMD-Source Areas*
Land clearing, earthmoving, and other mining operations activities that utilized 30% of Atlas mines mineral lands for direct mining and 50% for support facilities & infrastructures	Loss of tree cover/forest, pollution, denudation, degradation of land and water resources, loss of habitat, terrestrial & aquatic flora/fauna & biodiversity, Soil Erosion	• Rehabilitation of denuded areas through resumed reforestation and afforestation. • Minimization of site clearing in future mine development. • Preservation and expansion of wild life habitat to promote and enhance natural breeding and diversity of fauna. • Reforestation programs
Solid, hazardous wastes generation from industrial processes and domestic (offices & residences) within the minesite & port operations	Pollution and contamination of land and water resources; threat/risk to people's health	• Collection and segregation of recyclable waste on-site prior to transportation by a waste contractor for off-site recycling where possible. Provision of Materials Recovery Facilities and implementation of wastes segregation, reuse recycling, and waste minimization program • Handling and storage of toxic/hazardous, medical and special wastes and disposal by accredited hauler and treater • Composting of food and biodegradable wastes
Spillage of oil, lubricants/hydrocarbon contaminated materials from access roads, mine and mill areas, maintenance workshops, motorpool and other support facilities	Soil/ground and water resources contamination/ deterioration	• Contaminated soils will be treated and then reused as fill • • Excess treated soils will be stockpiled for rehabilitation and revegetation • Contaminated containers to be returned to supplier

		• Handling and storage of toxic/hazardous, e-wastes and special wastes and disposal by accredited hauler and treater • Provision of oil-water separators
Domestic Sewage, wastewater effluents from admin/offices, field offices/substations, housing, clubhouse, hospital	Water resources and soil/ground contamination	• 3-chambered Septic Tanks, Wastewater Treatment facilities • Regular de-sludging of septic tans/WTF by accredited de-sludging contractors

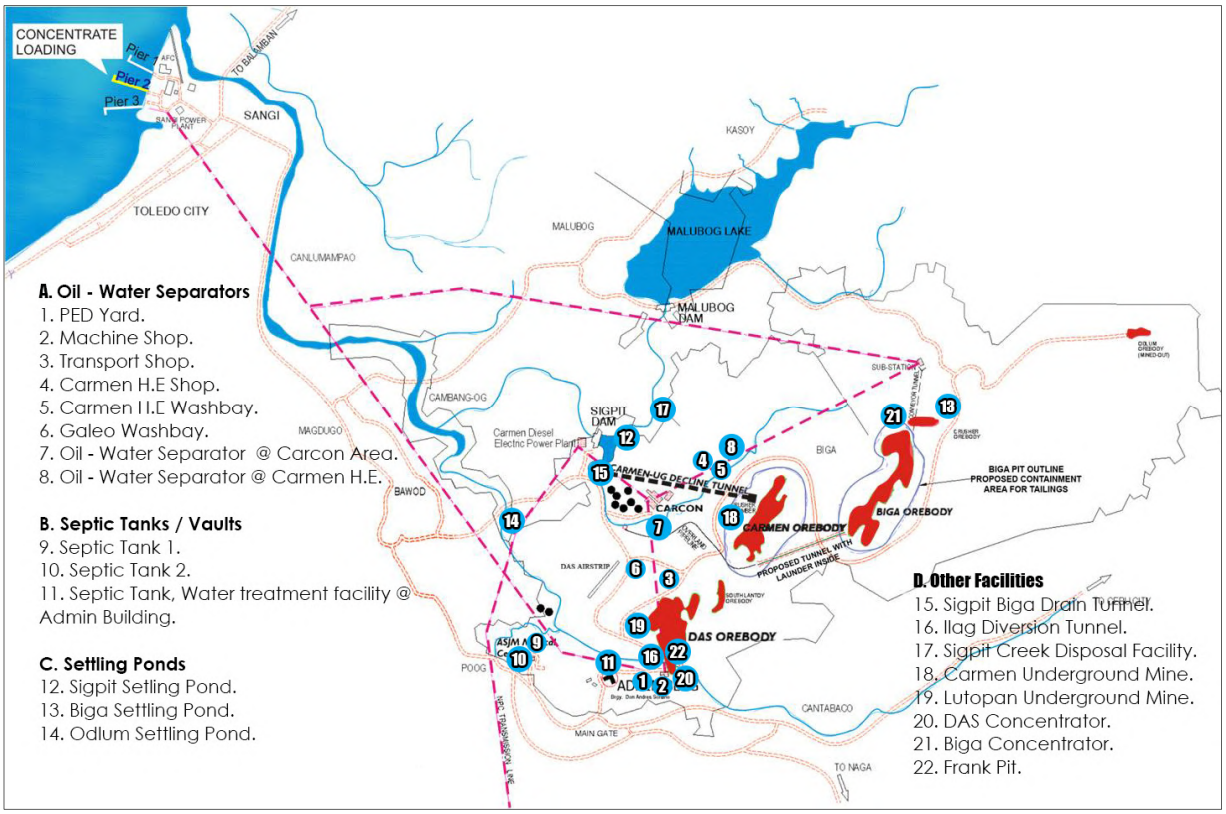


Figure 1.26 Location of Water Treatment Facilities

1.2.8 Project Size/Ore Reserve Estimates

a) Total Amount of Ore/Mineral Reserves in the project area based on exploration data*; AMC 2010 estimated Ore Reserve was 480Mt with 0.34% Cu (Carmen and Lutopan deposits).*

b) Total amount of Ore/Mineral Reserves to be extracted, rate of extraction and timetable; *442Mt with 0.33% Cu of Ore Reserve as of January 2020 and current average rate of extraction is 50k tons per day.*

c) Source material that will be fed to the mineral processing operation; *A Porphyry Copper deposit which was being mined through open pit method. Chalcopyrite and bornite are the main copper bearing minerals hosted by metavolcanics and diorite rocks.*

Ore reserves/resources.

Carmen Copper Corporation (CCC) commissioned AMC Consultants Pty Ltd (AMC)[8] to provide an estimate and report Mineral Resource and Ore Reserve for Atlas Mining deposits (Carmen and Lutopan) in accordance and consistent with the JORC[9] code.

The Mineral Resources for Carmen and Lutopan were previously estimated by AMC in 2010 and reported in 2011 while Ore Reserve estimates was developed on the first quarter of 2012, which was based on subsequent studies completed between late 2009 and December 2010.

In 2017, AMC was engaged again by CCC to undertake a package of work to provide Ore Reserve estimates and a framework for development of the Toledo Copper Mine based on the latest technical and financial information. The works include update of the Mineral Resource model for the Carmen deposit, pit optimization, long term and incremental pit designs, and an updated Mineral Resource and Ore Reserve report.

The changes from the previous Mineral Resources of 2010 for Carmen and Lutopan are due to the following aspects;

- New resource drilling, correction of data (historical) errors, revision of the interpretation of the geology, and revision of some of the estimation parameters based on the additional drill holes
- Reclassification of some Measured Resources at Carmen as Indicated Resources due to geological uncertainty arising from gaps in the drilling
- Small increase in the cut-off grade which is revised to match current marginal cut-off grade
- Depletion factor due to mining and processing operations
- Reporting within open pit shells constrained by new slope parameters and environmental, community, and government approval constraints.

Ordinary kriging was the methodology used to estimate copper grade into the three dimensional block model using the flagged 15 meter composites in Datamine Software. The kriging parameters for copper grade were subjected to a series of kriging neighborhood analysis (KNA) evaluations to optimize the estimation parameters. Estimates were based on interpolation into 30 meters (N) by 30 meters (E) by 15 meters (elevation) parent cells. Block discretization points were set to 4 (E) by 4 (N) by 2 (elevation) points.

Carmen and Lutopan deposits contains broad zones of mineralization and the mineral resource models are based on a parent sell size of 30 meters x 30 meters x 15 meters, sub-celled as required at geological contacts down to a minimum of 7.5 meters x 7.5 meters x 3.5 meters. The mineral resource models contain Measured, Indicated and Inferred Mineral Resource blocks and unclassified material.

The ore reserve estimates are based on the resource model contained within pit designs for Lutopan and Carmen deposits, where the total ore reserve estimates are from the Measured and Indicated Mineral Resource while the Inferred Resources are excluded from the ore reserve estimate in accordance with the JORC code.

The final pit limits were determined by AMC using Whittle Four-X (W4X) Lerchs-Grossman pit optimization software to assess the economic limits of the Carmen and Lutopan open pits. Inputs to pit optimization are the mineral resource model, overall pit slope angles, metal prices, deductions for charges by metal refiners and smelters processing recoveries, mining costs and operating costs (ore processing, G&A, transport and sales, and royalty costs).

[8] AMC Consultants is a leading mining consultancy, providing services exclusively to the mineral sector. Headquartered in Melbourne and has offices in Adelaide, Brisbane, Melbourne, Perth, Toronto, Vancouver, Singapore and Maidenhead in the UK.

[9] Joint Ore Reserves Committee (JORC Code) is an Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves establishes standards for public reporting, emphasizing principles of transparency and materiality.

As of January 2020, the updated Ore Reserve of Atlas Mining deposits for Carmen and Lutopan is 425.5 million tonnes with an average grade of 0.33%Cu at 0.20%Cu cut-off grade. The updated ore reserves was depleted from AMC 2018 block model with estimates computed using year-end surface within optimized pit shell at +0.20% Cu being the cut-off grade.

Table 1.24_Showing the individual Ore Reserve Estimates

CCC Ore Reserves as of December 31, 2019 @ 0.20% Cu cut-off									
Deposits	**Proven Reserves**			**Probable Reserves**			**Combined**		
	Tonnage	Grade	Pounds	Tonnage	Grade	Pounds	Tonnage	Grade	Pounds
	(millions)	(%Cu)	(millions)	(millions)	(%Cu)	(millions)	(millions)	(%Cu)	(millions)
Lutopan	140	0.31%	957	70	0.31%	478	210	0.31%	1,435
Carmen	162	0.36%	1,303	53.5	0.34%	398	215.5	0.36%	1,701
Total	**302**	**0.34%**	**2,259**	**123.5**	**0.32%**	**877**	**425.5**	**0.33%**	**3,136**

1.2.9 Description of the Operations and Maintenance of the Mine Components

The Toledo Copper Mines is on a 24-hour operations with CCC regular employees and contractors working in three (3) shifts spanning eight (8) hours each. The Carcon Mill facility as well as the mining operations runs 24/7. Annual operating time is 8,322 hours based on 95% equipment availability, 5% is for maintenance at 438 hours

Regular (on a daily basis) check-ups and inspections is conducted to ensure all facilities are operating at their optimum and to minimize malfunction and occurrence of incidence.

Strick implementation of preventive maintenance program of the Carcon mill facilities, equipment, and machineries to prevent occurrence of unwanted outages. Repairs on the Carcon facility will be scheduled and carefully planned to avoid delays in operations.

Regular monitoring of the Biga Pit Tailings Storage Facility (BTSF) are conducted to check on its stability, drainage and water quality among others. Monitoring piezometers and accelerometers were installed at strategic locations throughout the BTSF to monitor for deformation, movement, leaks, seepage and other abnormal occurrences to prevent incidents, breach, or loss of containment. An alarm and emergency response system are put-in-place as part of the Emergency Response Plan to serve as the warning devices in the unlikely occurrence of TSF failures and other incidents.

Lubrication activities normally conducted in parallel with mechanical major maintenance activities. Unless there is critical finding or observation related to lubrication, then permit to stop the equipment will be requested from both operations and maintenance.

Table 1.25 Replacement of BM3 DE Trunnion Liner

	PREPARATORY ACTIVITIES	Status	%	Duration (Houe)
1	Grind out Mill/Preparation of materials and tools	Plan	1%	0.5
		Actual		
2	Complete all tagging and isolation procedures	Plan	1%	0.50
		Actual		
3	Removal of DE Trunnion cover	Plan	1%	0.5
		Actual		
4	Pull-out of trommel assembly	Plan	2%	1

		Actual		
5	Removal of trunnion liner bolts	Plan	12%	6
		Actual		
6	Pull-out/cutting of splash bowl	Plan	12%	6
		Actual		
7	Setting of Fabricated Trunnion liner puller (A-frame) and full welding	Plan	21%	10
		Actual		
8	Setting of jack bolt and hydraulic jack	Plan	8%	4
		Actual		
9	Pull out existing trunnion liner	Plan	21%	10
		Actual		
10	Installation of new spare trunnion liner and bolt tightening	Plan	10%	5
		Actual		
11	Removal of A Frame	Plan	6%	3
		Actual		
12	Reinstallation of DE Trunnion Cover	Plan	2%	1
		Actual		
13	Housekeeping	Plan	2%	1
		Actual		
Update		total duration hr.	100%	48.5
Parallel Activities (Lube)				
1	Repacking of FC head/tail pulley	Plan	8%	3
		Actual		
2	Servicing of FC coupling	Plan	8%	3
		Actual		
3	Change oil of motor bearing load side and free side	Plan	8%	3
		Actual		
5	Replacement of return oil line supply	Plan	8%	3
		Actual		
Parallel Activities (Electrical)				
1	Inspection/Service/Clean Ball Mill Control Panel, Exciter Panel and control auxiliaries	Plan	8%	3
		Actual		
2	Inspection/Service/Clean Ball Mill Main drive motor, carbon brush assembly, motor auxiliaries and interlocking device	Plan	8%	3
		Actual		
3	Inspection/Service/Clean High & Low Pressure Lube pump FE & DE motors, pinion lube pumps and controls	Plan	5%	2
		Actual		
4	Conduct megger test and contact resistance test on Magnet Blast for comparison previous test	Plan	8%	3
		Actual		
Parallel Activities (Instrumentation)				
1	PM & inspection of triad cable wired on RTD sensors	Plan	5%	2
		Actual		
2	PM & inspection conduit & cable ladder	Plan	5%	2
		Actual		
3	Servicing / Cleaning and functional testing of Cyclone Pneumatic Valve Control	Plan	5%	2
		Actual		
4	Servicing / Cleaning and functional testing of Pinion Spray Lubrication	Plan	5%	2
		Actual		
5	Loop checking / Calibration of Pressure & Temperature Transmitter	Plan	5%	2
		Actual		
6	Conduct Ramsey Totalizer Calibration & Servicing of Field Instruments	Plan	5%	2
		Actual		
7	Servicing / Cleaning and functional testing of Air Clutch control	Plan	5%	2
		Actual		
Update		total duration hr.	100%	37.00

1.2.10 Development Phases

1.2.10.1 Introduction/development of Facilities Modifications

1.2.10.1.1 Description

The Toledo Copper Mines has been in operations for quite some time and the facilities and infrastructures are already operational. However, the following facilities modifications will be proposed/introduced:

a. Enhancement of the CarCon Facility
b. Modifications of the Airstrip Site Waste Rock Dump facility

There will be no major construction activities that will be undertaken as the existing operations and major machineries, structures and facilities will remain as it is. The upgrading and enhancement of the Carmen Concentrator facility will be in the ore sorting and processing, where the establishment of the Ore Sorting plant will be introduced and integrated into the existing process-operations of the Carcon facility.

The modification of the Airstrip WRD facility is due to the following:

a. Introduction of a crushing facility within the area to process the waste rocks and turned into aggregate commodities, thereby reducing the volume of waste rock stored in the landfill
b. Reduction of the total landfill area as there are portions that will not anymore be included/utilized for WRD

1.2.10.1.2 Pre-Construction and Construction Phases

Both the Carcon and Airstrip WRD facilities modification-enhancement will involved the undertaking of pre-construction and construction activities/works. The pre-construction undertakings will basically involved – Planning/Detailed Engineering Design, procurement of the necessary permits and clearances (including this ECC) and bidding/awarding of contracts to a building contractor.

The typical construction activities includes the following works: clearing and grubbing, site preparation, site civil works and building construction.

1.2.10.1.3 Project Cost and Implementation Schedule

The project modifications that includes introduction of new facilities in the Carcon Facility and the Airstrip Site WRD will have an estimated cost of PhP 6,341,462,805; of which the Airstrip WRD modifications comprises 96.5% of the total cost.

Table 1.26 Project Cost and Implementation Schedule

	ITEM/PARTICULARS	Amount	Schedule of Construction/Implementation
1	CARCON		
	Proposed CDP Office & Warehouse	1,973,170	On-going construction
	Sorting facility	1,989,637	On-going construction
	New Machineries/Equipment		
	Others		
2	AIRSTRIP SITE WRD		
	Crushing Facility	217,500,000	On-going construction
	Expansion/Modification of WRD	6,120,000,000	No activity yet
	Others		
	TOTAL	**6,341,462,807**	

1.2.10.2 Operation Phase/Stage

The operation stage includes the management of various operational activities in the areas of mining, processing, transport of products, administration and others.

Development Schedule. Based on the current approved Life of Mine, from 2021 to the present (2022), all mining activities are limited within Carmen Pit and will continue until 2032. While mining activities within Lutopan pit will start on 2031 until 2033.

Area affected by the actual mining activities for Carmen and Lutopan Pit is about 345.12 hectares. A total of 238,950,066 metric tons of ore and 537,064,790 metric tons of waste will be mined from 2021 – 2033.

Table 1.27 Mining Plan

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
CARMEN PIT													
Carmen Ore Mined	14,953,613	19,796,907	17,681,195	20,781,823	18,119,527	21,522,367	16,255,027	19,321,193	14,258,370	17,747,551	17,951,787	14,136,926	
Carmen Waste Mined	13,346,375	24,003,088	30,498,798	37,778,163	47,580,467	55,127,616	64,044,963	61,198,786	7,641,627	2,327,448	2,123,213	1,558,238	
Cu Grade Mined (%)	0.300	0.300	0.272	0.306	0.373	0.411	0.337	0.283	0.325	0.356	0.364	0.399	
Stripping Ratio	0.89	1.21	1.72	1.82	2.63	2.56	3.94	3.17	1.82	2.08			
LUTOPAN PIT													
Lutopan Ore Mined											570,641	8,241,996	17,611,145
Lutopan Waste Mined									18,249,997	34,674,993	39,579,351	41,942,819	55,388,849
Cu Grade Mined (%)											0.246	0.275	0.249
Stripping Ratio											69.36	5.09	3.15
TOTAL													
Total Ore Mined	14,953,613	19,796,907	17,681,195	20,781,823	18,119,527	21,522,367	16,255,027	19,321,193	14,258,370	17,747,551	18,522,427	22,378,921	17,611,145
Total Waste Mined	13,346,375	24,003,088	30,498,798	37,778,163	47,580,467	55,127,616	64,044,963	61,198,786	25,891,624	37,002,441	41,702,564	43,501,056	55,388,849
Cu Grade Mined (%)	0.300	0.300	0.272	0.306	0.373	0.411	0.337	0.283	0.325	0.356	0.361	0.353	0.249
Ore to Crusher	13,518,874	18,250,000	18,250,000	18,300,000	18,250,000	18,250,000	18,250,000	18,300,000	18,250,000	18,250,000	18,250,000	18,300,000	18,250,000
Cu Feed Grade (%)	0.262	0.293	0.286	0.318	0.360	0.396	0.371	0.298	0.300	0.346	0.355	0.359	0.290
Total Material Moved	28,299,988	43,799,994	48,179,993	58,559,986	65,699,994	76,649,983	80,299,990	80,519,979	40,149,994	54,749,993	60,224,991	65,879,978	72,999,995
TPD	100,000	120,000	132,000	160,000	180,000	210,000	220,000	220,000	110,000	150,000	165,000	180,000	200,000
Stripping Ratio	0.89	1.21	1.72	1.82	2.63	2.56	3.94	3.17	1.82	2.08	2.25	1.94	3.15

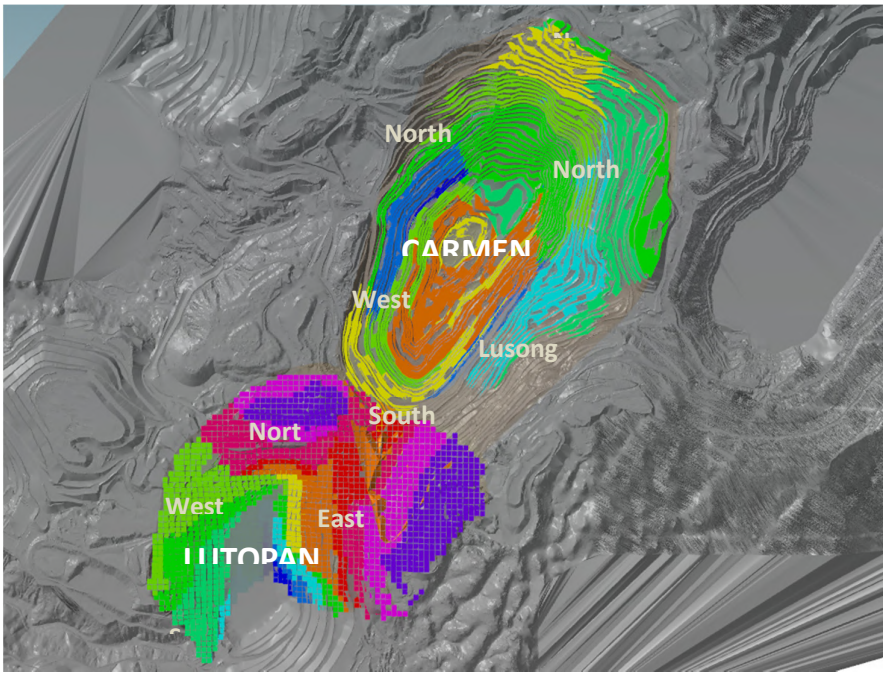


Fig 1.27 Carmen and Lutopan Pits

Status Development. The Three-Year Commercial Production Work Program (2020 to 2022) noted the "daily production of ore will increase to approximately ~ 50,000 tonnes per day, this is in line with the mill ramp up plan at the start of year 2020. This amounts to 54.30 million tonnes of ore mined for

the 3 year period. Combined waste production and waste stripping is 68.11 million tonnes. Summary of ore and waste production is shown below":

Summary of the Carmen Pit Ore and Waste Mine Production Plan

Particulars	2020	2021	2022	Total/Average
Ore (Million Tonnes)	18.09	18.10	18.11	T/ 54.30
Ore TPD	49,562	49,589	49,616	A/ 49,589
Grade (%Cu)	0.3335	0.3289	0.3563	A/ 0.3396
Waste (Million Tonnes)	42.50	16.22	9.39	T/ 68.11
Waste TPD	116,438	44,438	25,726	T/ 454,759
W:O Ratio	2.35	0.90	0.52	A/ 1.25

Description of Planned Activities. The stripping of waste in Carmen Pit_A and Carmen Pit_B involves the usual ramp system and entry road development prior to stripping activities. It is executed using both rental and in-house fleet.

Entry Road/Ramp Development. A 20-26 meter ramp/access road shall be established for purposes of stripping waste at every bench. A bund wall of 1.5 meters high on the crest side is established as a safety measure.

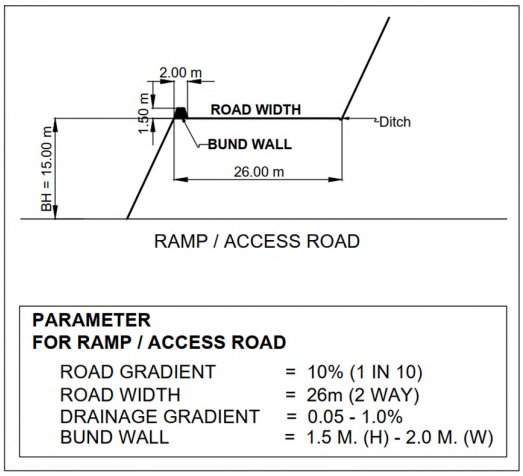


Figure 1.28 Ramp Access and Road Design

Stripping activities (topsoil and subsoil collection). Stripping at Carmen Pit_B commence at elevation 540 down. Stripped materials are dumped into the designated waste dumps (Biga, South Lutopan and Airstrip).

Phase 1 of stripping at the slide zone will commence at elevation 540m down to 480m.

Mine development and production including its mine lay-outs and design parameters. Ongoing development for waste stripping for 2021 is the upper elevation of Carmen Pit_B. The purpose of this area development is to expose the ore beneath the overburden and slide material. Plans to strip the nearby Lutopan ore body is still on hold. Completed 1 infill drilling and still under feasibility study.

For Carmen Pit_B on ore exposure and sustainability, area to consider for stripping includes North West, North and North East Wall (Elevation 480 down to 195).There will be approximately 12.5 million Cu. m. of waste to be moved until the ore zone will be exposed.
Lutopan Pit (Elevation 375-315N) removal of ore stockpiles

Targeted sites/areas is presented in a 1:10,000 location map with the corresponding technical description showing (i) Mine Site, Process Plant, Pier Stockyards, Camp Housing and other Facilities (ii) Biga Pit, (iii) Sangi Facilities, (iv) Malubog Pondage, and (v) Lutopan Pit, Mine Facilities and Staff Houses (see Attachment).

Estimated Daily, Monthly, Quarterly, and Annual Production. By 2022, daily production of ore will increase to approximately 52,000 tonnes per day (TPD), this is in line with the mill ramp up plan at the start of year 2020. This amounts to 56.74 million tonnes of ore mined for the 3-year period. Combined waste production and waste stripping is 68.92 million tonnes. Summary of ore and waste production is shown in Table 2 below.

Manpower/Human Resource, Organizational Structure and Contractors. The Carmen Copper Corporation underwent re-organization that totally upgraded the previous management structure that best responded to the needs of the company, organization and the community. It is now headed by the President & CEO and AVPs heading the operations of various departments.

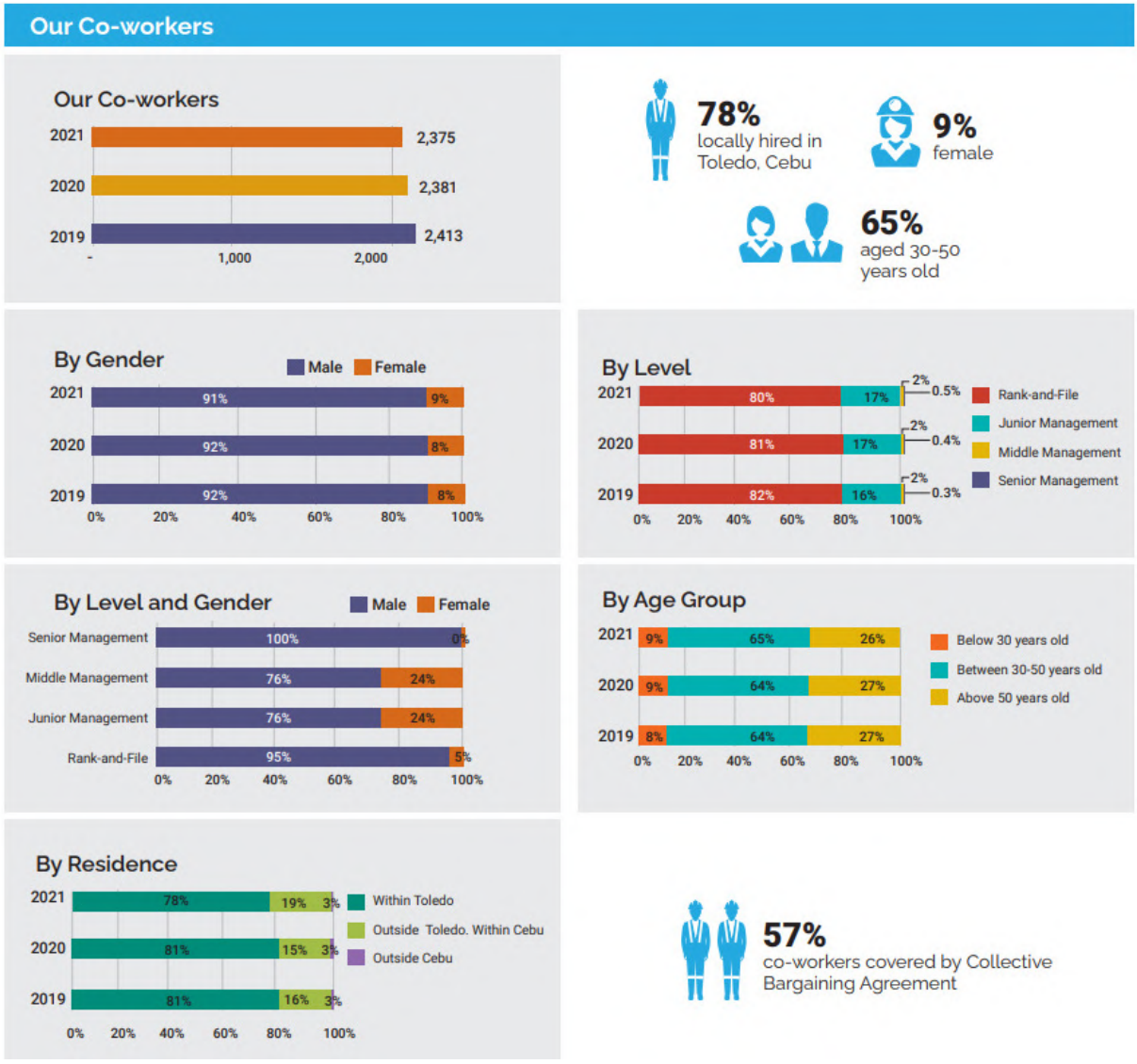


Figure 1.29 Profile of Manpower/Personnel by Residence, Gender, Age-group

Table 1.28 Service Contractors, type of services & Manpower, 2021

Name of Contractors	Services
Direct Contractors	
Anseca Development Corporation	Equipment rental on mine support and hauling of concentrates
ASM Construction Services	Equipment rental and Infrastructure projects
CD Processing (Phils.) Inc.	Ore sorting process
DS Trading	Equipment rental and Infrastructure projects
Ebcard Construction Services	Equipment rental and Infrastructure projects
EPIROC-Philippines Inc.	Maintenance support on drilling equipment
Higantis Contractors Corp.	Supply and maintenance of tires for heavy equipment
Junver Construction	Equipment rental and Infrastructure projects
Le-Price International Corporation	Supply and maintenance of fire suppression for heavy equipment
Maxima Machineries Incorporated	Supply and maintenance of heavy equipment
Monark Equipment Corporation	Supply and maintenance of heavy equipment
Morse Hydraulics System Corporation	Supply and maintenance of hydraulic hoses
Northernstar Fuel Facilities Solution Inc.	Supply and maintenance of Fuel stations
Orica Philippines Inc	Supply and storage of explosive devises and materials
Philbelt Manufacturing	Supply and maintenance of conveyor belt
Toledo Shipping Agency & Marine Services	In-charge in PMS and support service during ship loading activity of copper concentrates
Indirect Contractors	
Nautilux Mining Corporation	In-charge in mine waste disposal
Petrostec Development Corporation	In-charge in mine waste disposal

Mine Safety, Health and Environmental Protection

After the tragic landslide that occurred at the Carmen open pit's north wall on 21 December 2020, CCC updated its Three-Year Commercial Production Work Program (2020 to 2022) to incorporate measures to prevent recurrence of similar incident, and noted the following:

> "*In the next 3-year program, it will involve mainly continuation of onsite investigation/verification and assessment of the environmental impacts - past, present and future - which have affected and/or may continue to affect the various ecosystems interacting within the area embraced and/or influenced by the CCC mining operations. However, for some major impacts already identified and currently undergone monitoring under the company's operation program, the succeeding phases of environmental protection were already applied and are accordingly included in the yearly activities…*

The estimated cost for Environmental Protection and Management amounting to PhP472.563 Million for the three (3) year (2020–2022) operation of Carmen Pit is summarized in the table below:

Impact Control Component	2020	2021	2022	Total
Slope Stabilization and Erosion Control	9.45	9.45	9.45	28.354
Reforestation/Revegetation	9.45	9.45	9.45	28.354
Drainage Improvement, River Rechanneling & Dredging	18.90	18.90	18.90	56.707
Sedimentation Control and Silt Dam Construction	59.85	59.85	59.85	179.574
Acid Mine Drainage Control	25.20	25.20	25.20	75.610
Noise and Vibration Control	6.30	6.30	6.30	18.902
Dust and Gas Emission Control	12.60	12.60	12.60	37.805
Aesthetic Enhancement	9.45	9.45	9.45	28.353
Environmental Monitoring	6.30	6.30	6.30	18.902
TOTAL	157.521	157.521	157.521	472.563

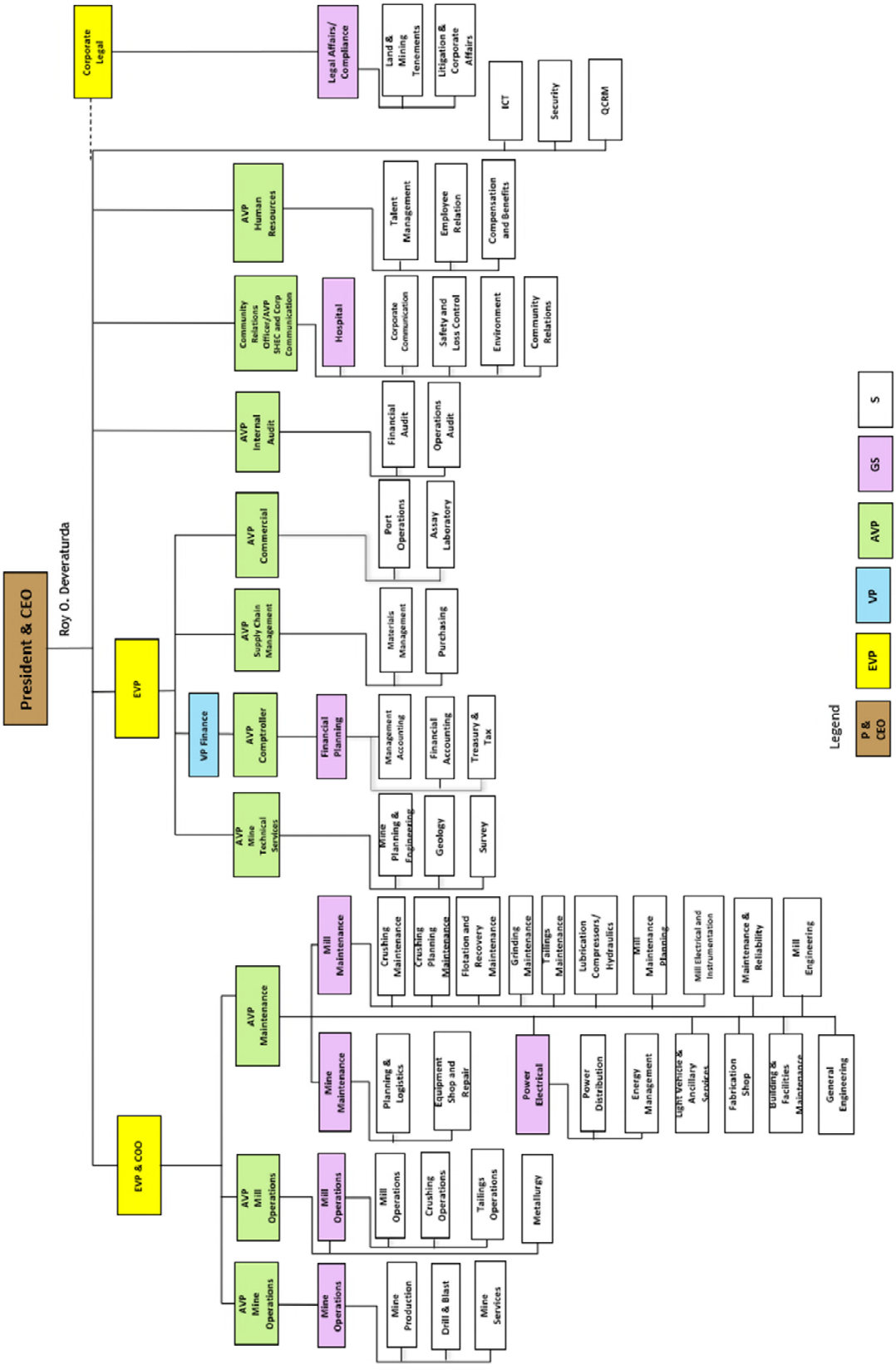


Figure 1.30.General Organizational Chart

1.2.10.3 Abandonment Phase

The FMRDP 2010 indicated the following Mine Closure and Rehabilitation Scenarios:

- Generally, all infrastructure, facilities, and equipment listed as fixed assets as per CCCACMDC operating agreement shall be turned over to Atlas, if not, stored/maintained for future use of CCC mining projects. Otherwise, if agreed by both parties, these will be turned over to other stakeholders for their sustainable use and development. Those which do have future use will be demolished.
- All onsite electrical and water reticulations and other items recovered from the decommissioning/demolition activities will be sold or disposed of appropriately. Those that are still usable for future projects of CCC or ACMDC shall be subjected to safekeeping.
- Abandoned areas, waste rock dumps, and mined-out areas, among others will be environmentally rehabilitated.
- In some areas, progressive rehabilitation/revegetation will be conducted, however, only after concerned operation areas give clearance to the Reforestation Section. Other areas that are directly affected or are continually used relative to mine operations during mine life will be subjected to revegetation only after final mine closure.
- Socio-economic impacts as a result of mine closure will be addressed appropriately through the SDMP.
- Handover of infrastructure, facilities and rehabilitated land will be negotiated with the identified stakeholder groups with the assurance of the beneficiary stakeholder groups that such will be sustainably used, developed or managed. Where applicable, issuance of appropriate tenurial instruments by concerned government agency shall be made.

PART 2. ANALYSIS OF ENVIRONMENTAL IMPACTS

2.1 LAND

2.1.1 Land Use and Classification

2.1.1.1 Impact in Terms of Compatibility with Existing Land Use

Land Use Pattern. The General Land Use Plan (2006-2015) of Toledo City (see Fig.4.1 below) exhibited the 'mining area/zone' comprising a substantial portion of the entire city (a total of 4,717.50 hectares or comprising 21.82 percent of the total land area). The Toledo Copper Minesite is located within this classified mining area/zone.

The port facility located in the 'urban district (see Figures 2.2. and 2.3) is within an industrial zone.

While the direct/primary impact area of the Toledo Copper Mines within the properties of ACMDC/CCC and within the classified mining areas of the Land Use/Zoning Map of Toledo City, the indirect/secondary impact areas are predominantly zone as agricultural.

Areas of Brgys. Media Once, Canlumampao, Magdugo, and Ilihan along the Sapangdaku River are generally agricultural, while that of Sangi, Daanglungsod and Dumlog are urban areas. Ecotourism sites are also identified in Cantabaco, Bagacay, Ilihan, DAS and General Climaco. The Lower Sigpit River-which is within Brgy. Canlumampao is predominantly classified as Forestland. Brgy Biga where the TSF enhancement and Marcona WRD are located are classified as Mining Area and the rest of the barangay as 'Agroforestry'

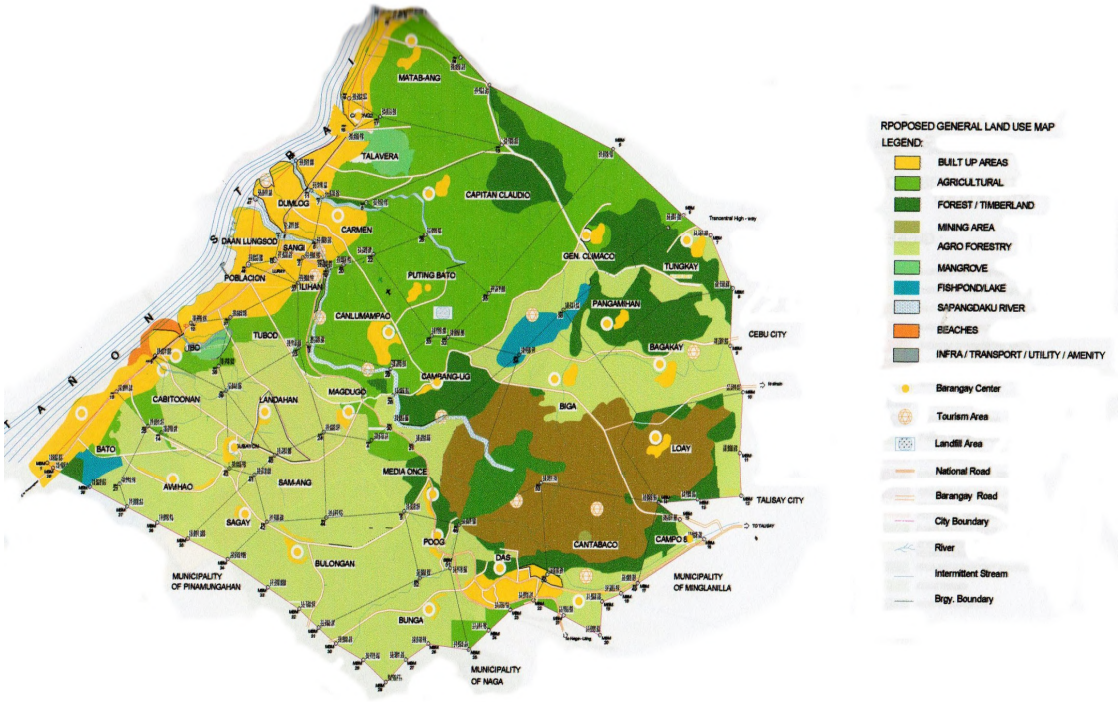


Fig. 2.1 Toledo City Land Use Plan/Zoning Map

The Sapangdaku river basin and the shaping of Toledo City's land use pattern are significantly linked. The city's CLUP noted.. "through the years, the Sapangdaku River..has provided significant contributions in history and economic activity of the City of Toledo". Because of its importance to the

City, the CLUP included the Sapangdaku Environmental Management Program (SEMP). Given that the Sapangdaku river is the outfall of the Biga TSF overflow waters, the SEMPs goals, objectives, strategies, and projects are relevant to addressing concerns which the Toledo Copper Mines TSF project are perceive to cause, contribute or influence environmental degradation of the project's downstream/indirect impact areas. The SEMP aims to fulfill the following:

- To rehabilitate and stabilize the protection forest areas and the Sapangdaku River bank which will mitigate impact on disasters and natural calamities;
- To increase supply of food and fiber products and to generate additional sources of income and livelihood that help in the economic upliftment of the Toledanos;
- To generate additional sources of funds tha can be used by the City of Toledo for improving environmental management and conservation activities of the City
- To provide security of tenure to claimants or stakeholders along the Sapandaku Watershed;
- To establish an enduring partnership between the City of Toedo, the DENR, the permittees, forestland users and all other stakeholders in promoting the sustainable use of the Sapangdaku Watershed

The SEMP projects (CLUP) that complements and contributes to mitigation of the Toledo Copper Mines perceive impacts are as follows:

- Rehabilitation, Protection and Development of the Sapangdaku River. The river is a valuable natural asset of the city. It is the source of irrigation water for the rice farms of Cambang-ug and Canlumampao. Its sand and gravel has been considered as Class A and major source for filling materials. However, the Sapangdaku river has been greatly damage due to sporadic and illegal extraction of San and Grave. The denuded forestland areas and human activity in upland areas. If left unattended the river will bring disaster to the community.
- Reforestation and stabilization of River Banks. The non observance of easement areas by some permitted further enlarged the width of Sapangdaku River. River banks have been eroded and brought damage to properties and to rice farms. River banks should be planted with forest trees or bamboo grasses to strengthen soil stability.
- River Rechanneling. Permittees along the Sapandaku River shall be allowed to conduct the rechanneling activity. The reference point shall be the center of the flood control dike and extend 40 meters on both sides. Beyond the 40 meters are considered as river easement and shall not be quarried.
- Water Quality Control. Crushing plants in the area shall have a water treatment pond or silting ponds for the waste water before throwing it to the river. The existing multi-partite monitoring team shall frequently conduct water quality monitoring on the different sampling station.
- Food Control. A flood control structure shall be constructed along the side of Daanlungsod and Dumlog towards the mouth of Sapandaku. The existing industries s and communities living in the area, it is necessary to protect the areas against possible overflowing the the river. The city engineering shall prepare the necessary program of wok for the construction of the flood control dikes.
- Desiltation of Sapangdaku Delta.
- Development of Sapangdaku River Park

Change/Inconsistency in Land Use. The Toledo Copper Mines operations is consistent and in conformance with the 'mining area/zone classification' of the Toledo City CLUP and zoning ordinance.

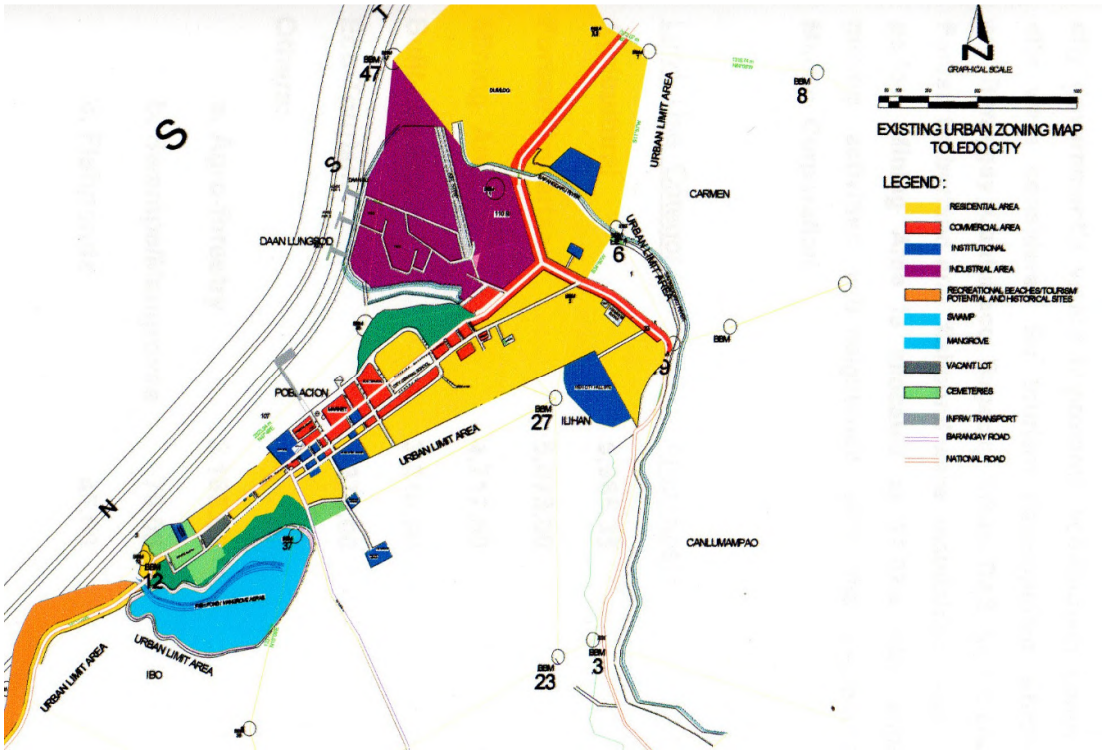


Fig. 2.2 Toledo City Existing Urban Land Use Map (Source: CLUP)

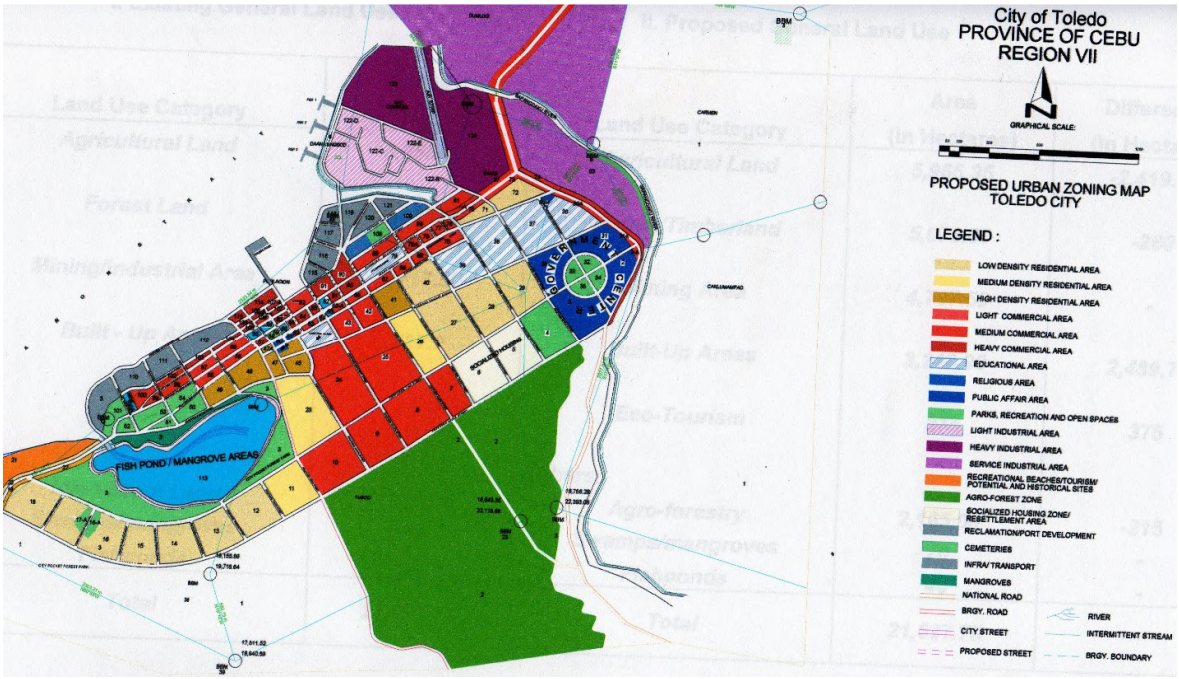


Fig. 2.3 Toledo City Proposed Urban Land Use Plan

The TCM project area with a total land area of 4,849.23 hectares is comprised of 57% A&D and 43% Timberland areas, most of these areas are within the MPSAs.

Table 2.1 Land Classification Status Within the TCM Minesite/Property

Description	A&D	Timberland	Total
MPSA Consolidated and Malubog	2,752.80	2,091.93	4,844.73
Sangi Port	4.50		4.50
Total	2,757.30	2,091.93	4,849.23

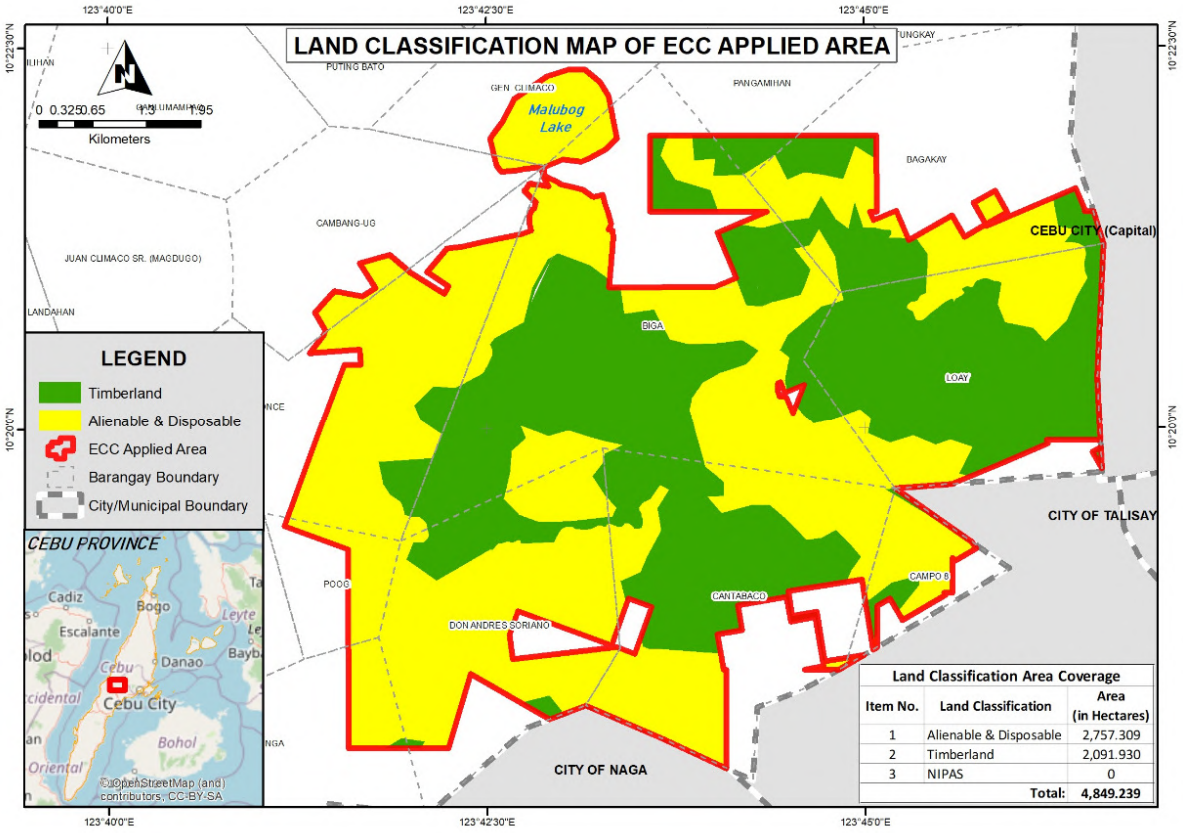


Fig. 2.4 Land Classification Map

Impacts Mitigation and Enhancement

The land use pattern of the mine site and surrounding areas has been established through the years the Atlas Mines and now the TCM has been in operations. The presence of the WRDs around the minesite were not new for the community, thus, the residents were already used to the visual and aesthetic impacts of these facilities.

The FMRDP 2010, has indicated the following post-mining land use for the TCM:

The waste rock dumps, tailings covered areas, mined-out areas, and other waste areas which are not covered with topsoil prior to planting shall initially revert back to at least a vegetated area with grasses/shrubs or monocropped forest tree plantation within at least 5 years after mine closure. Progressive enrichment planting during mine life and natural succession after mine closure will

facilitate approaching of the tree plantation/revegetated areas into a diverse forest and with natural recruitment of wildlife species. The use of such areas for grazing, agriculture, or fruit tree orchard purposes are to be discouraged if no proof that non-bioaccumulation of heavy metals by plants occurs.

Other areas not covered by above types shall either revert back to agricultural and grazing lands (for slopes less that 18%) or a forest with diverse species, preferably of indigenous species, which are set aside for strict protection purposes owing to the nature of the area (i.e., environmentally critical as determined by government stakeholder groups such as the DENR). Proposed final land uses may be amended as this plan is revised.

Below are the proposed/planned final land uses:

- *Strict forest protection zone – area revegetated primarily with fast-growing exotic plant species and some indigenous forest tree species applicable and recommended as may be the results of the soil amelioration and bioremediation R&D. Enrichment planting activities throughout the rehabilitation period will also be initiated to increase diversity. Fauna habitat establishment and management shall also form part of this zone management;*
- *Production forest zone – area revegetated with fast-growing, exotic forest tree species with good coppicing ability (for fuelwood production) or thoroughly maintained for timber production purposes and/or area planted with species for biofuel production purposes. These are to be sustainably managed under a viable comanagement schemes or through issuance of appropriate tenurial instrument;*
- *Food production zone – area not directly affected by mining which shall be used for production of agricultural cash crops or high value crops, fruit tree orchards, if not, for use as pastureland/graze land purposes; and*
- *Ecotourism area managed under a viable co-management scheme.*

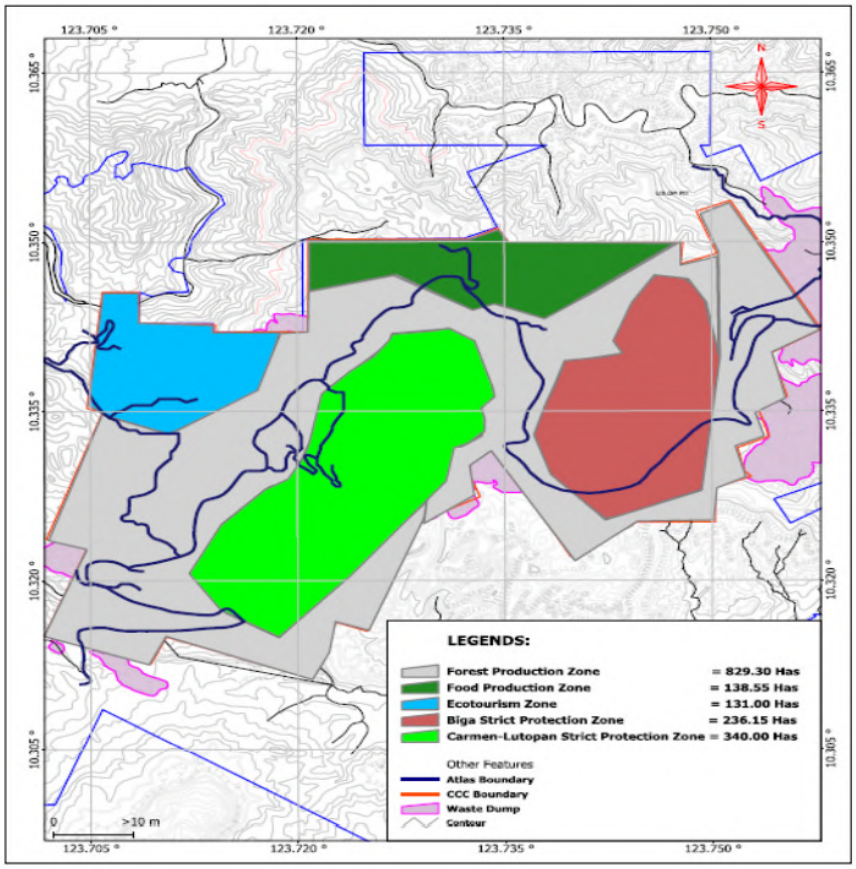


Figure 2.5 Proposed Final Mine Land use of TCM

2.1.1.2 Impact on Compatibility with Classification as an Environmentally Critical Area (ECA)

Encroachment in Protected Area under NIPAs. The Toledo Copper Mine is near to two NIPAs areas in Cebu, namely: the Central Cebu Protected Landscape (CCPL) and the Tanon Strait Protected Seascape (See Table _ and Figure __ below). The minesite is more or less 5-7 kilometers away, while the Atlas/CCC Port abuts the TSPS. The tenement boundary is also located outside of the CCPL.

Table 2.2 List of NIPAS Areas in Cebu Province

NIPAS Areas	Location/Coverage	Total Area (Hectares)
Guadalupe Mabugnao-Mainit National Park	Carcar, Cebu	57.50
Central Cebu Protected Landscape	Cebu City, Talisay City, Balamban, Toledo City, Compostela, Minglanilla, Liloan, and Consolacion – Cebu Province	29,062.00
Tanon Strait Protected Seascape for Marine Mammals	Bantayan Island, Daan Bantayan to Santander-Cebu Province. Sibuyan, Negros Oriental to Bago, Negros Occidental	450,000.00
Olango Island Wildlife Sanctuary	Sta. Rosa, Lapu-lapu City	920.00
Wilderness Area	Bantayan Island, Cebu Province	9,111.00
Argao-Dalaguete River Watershed Forest Reserve	Argao and Dalaguete, Cebu	7,250.00
Mangrove Swamp Forest Reserve	Camotes Group of Islands	

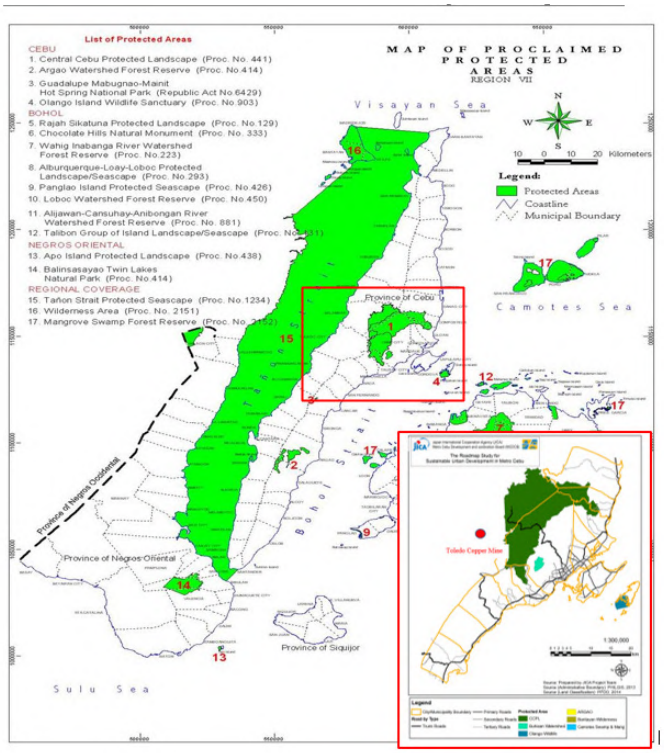

MAP OF PROCLAIMED PROTECTED AREAS
REGION VII
List of Protected Areas
CEBU
1. Central Cebu Protected Landscape (Proc. No. 441)
2. Argao Watershed Forest Reserve (Proc. No.414)
3. Guadalupe Mabugnao-Mainit Hot Spring National Park (Republic Act No.6429)
4. Olango Island Wildlife Sanctuary (Proc. No.903)
BOHOL
5. Rajah Sikatuna Protected Landscape (Proc. No.129)
6. Chocolate Hills Natural Monument (Proc. No. 333)
7. Wahig Inabanga River Watershed Forest Reserve (Proc. No.223)
8. Alburquerque-Loay-Loboc Protected Landscape/Seascape (Proc. No.293)
9. Panglao Island Protected Seascape (Proc. No.426)
10. Loboc Watershed Forest Reserve (Proc. No.450)
11. Alijawan-Cansuhay-Anibongan River Watershed Forest Reserve (Proc. No. 881)
12. Talibon Group of Island Landscape/Seascape (Proc. No. 431)
NEGROS ORIENTAL
13. Apo Island Protected Landscape (Proc. No.438)
14. Balinsasayao Twin Lakes Natural Park (Proc. No.414)
REGIONAL COVERAGE
15. Tañon Strait Protected Seascape (Proc. No.1234)
16. Wilderness Area (Proc. No. 2151)
17. Mangrove Swamp Forest Reserve (Proc. No. 1152)
Visayan Sea
Camotes Sea
Province of Cebu
Province of Negros Occidental
Province of Negros Oriental
Province of Siquijor
Sulu Sea
Legend:
Protected Areas
Coastline
Municipal Boundary
Kilometers
Toledo Copper Mine

Figure 2.6 NIPAs Areas in Central Visayas Region
(Source: https://troyelizaga.blogspot.com/2016/06/some-thoughts-on-planning-cebu-city.html, Inset: JICA 2015)

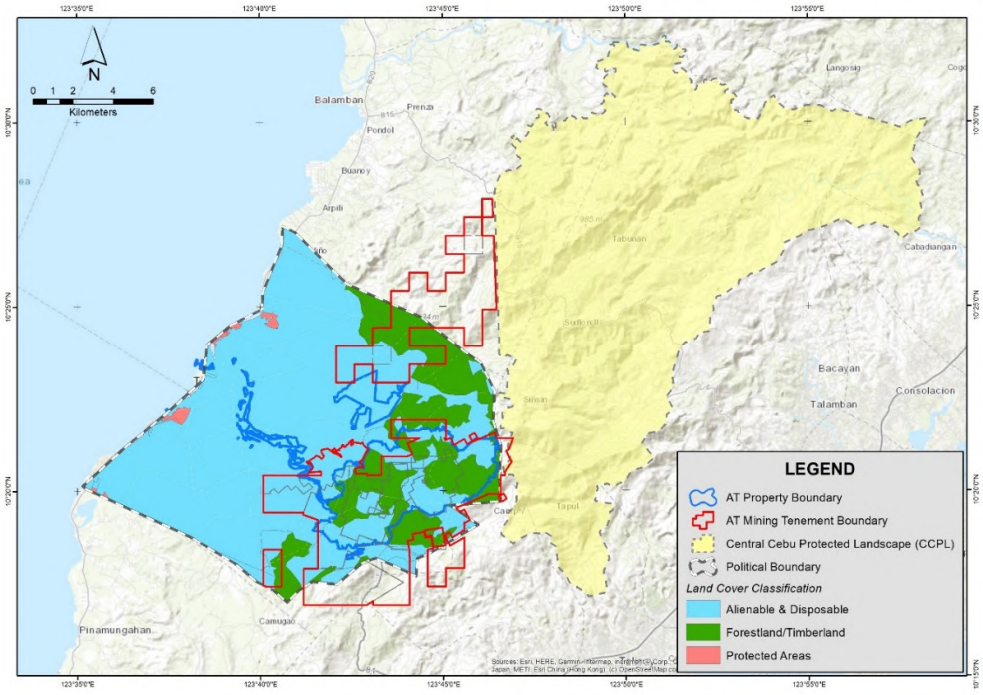


Figure 2.7 Minesite/Tenement and the CCPL Boundaries

Encroachment in Other Environmentally Critical Areas (ECAs). The Revised Procedural Manual for DENR Administrative Order No. 30, Series of 2003 (DAO 03-30) listed twelve (12) Environmentally Critical Areas (ECA) categories. Assessment of project's compatibility with ECA classification is presented in the following table:

Table 2.3 List of ECAs within/Near to AFC Facility

	ECA Category	Present within TCM	Remarks
1	Areas declared by law as national parks, watershed reserves, wildlife preserves, sanctuaries	Yes	The TCM is near to NIPAs, namely: a. Central Cebu Protected Landscape b. Tanon Strait Protected Seascape
2	Areas set aside as aesthetic potential tourist spots	3 potential attractions	The Toledo City CLUP identified the following sites within TCM 1. TCM as industrial tourism 2. Malubog dam for Eco-tourism The recently established Heritage Museum within TCM
3	Areas that constitute the habitat of any endangered or threatened species of Philippine wildlife (flora and fauna)	None	Sightings of the Black Shama, an endangered bird species in Tabunan forest within CCPL.
4	Areas of unique historic, archaeological, or scientific interest		
5	Areas that are traditionally occupied by cultural communities or tribe	None	None within the surrounding vicinities or the entire Cebu Province
6	Areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.)	None	
7	Areas with critical slopes	Yes	Some areas within the TCM site
8	Areas classified as prime agricultural lands	None	None within the TCM site
9	Recharge areas of aquifers		

10	Water bodies characterized by one or any combination of the following: tapped for domestic purposes; within the controlled and/or protected areas declared by appropriate authorities; which support wildlife and fishery activities	None	
11	Mangrove areas characterized by one or any combination of the following conditions: with primary pristine and dense young growth adjoining mouth of major river systems; near or adjacent to traditional productive fry or fishing grounds; areas which act as natural buffers against shore erosion, strong winds and storm floods; areas on which people are dependent for their livelihood	None	
12	Coral reefs characterized by one or any combination of the following conditions: With 50% and above live coralline cover; Spawning and nursery grounds for fish; Act as natural breakwater of coastlines	None	

Encroachment to Ilag River. The previous Airstrip-Ilag WRD Facility ECC also covers an area that encroaches the Ilag River (See Figure _ below). The Airstrip-Ilag WRD only utilized the Airstrip area for WRD facility operations, while the portion with the Ilag River has not yet been touched/developed. One of the modifications for this ECC amendment is the deletion/exclusion of this portion of the Airstrip WRD facility with the Ilag River area – this area will not be anymore developed for WRD, thus, maintaining the river/waterways and its surrounding areas.

Figure 2.8 Overlay of the Airstrip-Ilag WRD ECC covered areas and the Proposed Expansion

2.1.1.3 Impact on Existing Land Tenure Issues

The areas utilized by the Toledo Copper Mines are covered by an approved MPSA….

There are no known other tenurial instruments that conflict or overlapped with that of the ACMDC MPSA, such as but not limited to the following arrangement, namely: CARP, CADC / CADT / CALC / CALT or with IFMA / CBFMA.

2.1.1.4 Impairment of Visual Aesthetics

Among the potential negative impacts of mining, the visual impact of over burden dumping and *tailings disposal deserves special attention*. Visual impacts include aesthetic & scenic and landscape aspects. Visual and land use compatibility of rehabilitated mined land is the single most important consideration in designing a combination of landforms and revegetation processes. While there can be occasions where a change to a completely different land use is beneficial, for example from previous agriculture to industrial real estate, these opportunities are rare and explain why most rehabilitation programs are designed to return the land to its pre-mining use.

In certain cases, the effect on the landscape can be significant and unpleasant to the eye. Generally speaking, the significance of the change is linked to the topography of the area and to the type of landscape and vegetation. The significance of the visual impact depends on the distance, the weather conditions and the height of the viewpoint.

In any case visual impact is not easily discussed in absolute terms. Whether or not an over burden dump *or a tailings disposal facility* is unpleasant to the eye besides the subjective dimension of the question is very much a matter of integration into the surrounding environment. Physical screening, screen planting, landscaping and the use of existing features contribute to local surroundings. Clearly, it is difficult to measure visual impacts quantitatively through standards and regulations. It is generally agreed, that the value placed on a certain type of landscape is a subjective issue and in some cases, for example, authorities have refused permits for landscape reasons, when in fact, there is no opposition from local residents.

Figure 2.9 Photos taken of the Airstrip-Ilag WRD site (August 2011): *Left Photo:* Aerial View of the WRD/Landfill Site. Expansion area on the right side (with the Ilag River), and the Airstrip Site WRD on the foreground. *Fig. Right Photo:*. Aerial View of the Airstrip Site WRD/Landfill (left side of the Airstrip)

Figure 2.10 Photos Taken of Airstrip Site WRD

2.1.1.5 Devaluation of Land Value as a Result of Improper Solid Waste Management and other Related Impacts

Most of the solid wastes generated are generally municipal/domestic wastes that includes plastics, paper, discarded packaging and containers, bottles, etc. that comes from the administrative and field offices/stations and staff housing. The volume of wastes are not significant and is being properly managed, thus, it has no influence on the devaluation in the surrounding land values.

Table 2.4 Volume of Garbage Collected (in Kilograms)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2021	37,999	33,189	11,040	5,280	21,500	19,430	17,510	16,060	19,410	16,050	21,260	11,470
2022	18,000	14,500	15,800	15,860	13,960	14,243						

Total Volume of Recyclables given and pick up by community (ICABWA), as of July 15, 2022 - 400 kilograms

Table 2.5 Daily Garbage Schedule

ITEM NO.		DESCRIPTION	MON		TUE		WED		THUR		FRI		SAT	
I		**CAMP HOUSING**	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
	1	HAPPY VALLEY COMPOUND												
	2	MANAGERS COMPOUND												
	3	UPPER COMPOUND												
	4	LOWER COMPOUND												
	5	CARMEN COMPOUND												
II		**FACILITIES**												
	1	ADMIN BUILDING												
	2	ACCI (CANTEEN)												
	3	JUNIOR MESS (CANTEEN)												
	4	SECURITY												
	5	SLEEPING QUARTER												
	6	STAFF CLUBHOUSE												
	7	WATER REFILLING STATION												
	8	RECREATION CENTER												
	9	CCC HOSPITAL												
	10	ABACA WATER TREATMENT												
III		**TRAFFIC 1 TO CARCON AREA TO MINESITE**												
	1	DAS MACHINE SHOP/ PED												
	2	MAIN ASSAY LAB												
	3	KHYBER PASS AREA (***including GALEO, ANSECA & MONARK)***												
	4	MOP OFFICE ***(including DELTA& DS trading @ batching plant)***												
	5	LANDBASE Carmen 9												
	6	PRIMARY CRUSHER												
	7	***Orica***												
	8	STC AREA												
	9	POWER PLANT												
	10	MILL & FLOTATION AREA ***(including Junver, Aboitiz, Prince Ace)***												
	11	MET LAB												
	12	PUMPHOUSES ***(including sigpit area)***												
	13	TAILINGS												
	14	CARMEN H.E. ***(including Le Price, LEE Masters)***												

BIODEGRADABLE

NON BIODEGRADABLE

RECYCLABLE MATERIALS

HAZARDOUS

Table 2.6 List of Hazardous Wastes Facilities

Hazardous waste facilities	
Carcon bund wall	10,000 m³
Carcon used oil tank	150 MT
Carmen HE used oil storage tank	100 MT
Carmen HE used oil storage sub-tank	18.53m³
Carmen HE bund wall for of oil tank	121.0m³
Carmen HE bund wall for empty drums and oil contaminated materials	63.67 m³
Carmen HE bund wall for empty drums and oil contaminated materials	58.16 m³
Hospital (MRF)	60 m³
PED bund wall (used oil and empty drums)	17.57 m³
PED PCB bund wall	14.59 m³
Transport Shop bund wall	7.18 m³
PED storage at 2nd lift	360 m³
Assay bund wall (lead organic compounds)	8.0 m³
Assay container van for amber bottles	32.4 m³
Location 20- container van # 1	64.51 m³
Location 20- container van # 2	124.84 m³
Location 20- compartments	484.7 m³
Sangi hazardous waste facility	18.2 m³
Machine Shop	

2.1.2 Geology

2.1.2.1 Regional and Site Geology

Regional Geology. The island of Cebu geologically falls within the Central Physiographic Province of the Philippines, which is composed of cordilleras, lowlands, troughs and offshore basins. The island lies towards the central portion of the Visayan Basin and moderately interrupted by the uplift of the Cebu geoanticline in Late Miocene to Pliocene. The basement is mainly Cretaceous to lower Tertiary metavolcanics and metasediments, deep water and reefal limestone. These are intruded by diorite stocks and batholiths during the Paleocene to Early Eocene (*Bureau of Mines, 1982*).

Cebu Island has a NNE-SSW trending mountainous axis, about 160 km long and is flanked by intermediate highlands heavily dissected by deep narrow valleys with steep slopes. Narrow coastal plains skirt the hilly terrain and are principally coral reefs mantled by alluvial sediments.

General Stratigraphy. The Atlas Mine site is located on the west central portion of Cebu Island. The stratigraphy of this region reveals a complex sequence of lithologic units deposited from Pre-Cretaceous to Pleistocene (*Fig. 4.1*). Following is the stratigraphic sequence arranged from oldest to youngest within the regional vicinities of project site:

- *Tunlob Schist*. The oldest rock unit in Cebu composed mainly of chlorite-amphibolite schist. It is pre-Cretaceous in age probably Jurassic. It is located further north from the Atlas Mines District.

- *Mananga Group*. The oldest basement rock in the Atlas Mines district with an early Cretaceous age. It is subdivided into the metasediments (Pandan Formation), metavolcanics (Cansi Volcanics) and Tuburan Limestone.
- The *Pandan Formation* consists of a heterogeneous mixture of conglomerate, wacke, sandstone and shale of basic composition with intercalated basaltic flows. The lithic fragments include fine-grained porphyritic and amygdaloidal basalts and andesites, tuff and marbleized limestone.
- The *Cansi Volcanics* consist of a thick sequence of andesitic and basaltic lava flows grading from agglomeratic to amygdaloidal or porphyritic. Occasional fine to coarse grained tuffs and flow breccias are also present.
- The *Tuburan Limestone* occurs as small isolated ridge-top remnants in the highlands areas of Central Cebu. It is usually finely recrystallized, frsctured and healed by coarse white calcite veinlets. It is is typically light to dark gray color.
- The *Mananga Group* was subjected to low to moderate grade metamorphism during the emplacement of the quartz diorite stocks.
- The *Cebu Formation* of upper Oligocene age is divided into the lower *Cebu Coal Measures* and an upper Cebu Limestone. The Coal Measures are brown to grey coarse sandstone and shale with coal seams to a total thickness of 50-125m. The Cebu Limestone is a white, pure hard fossiliferous limestone with a thickness of up to 125m.
- *Malubog Formation*. It is composed mudstone, shale and occasional beds of conglomerate, limestone and coal. It conformably overlies the Cebu Formation, with a lower Miocene age. It is generally exposed as low rolling hills in the vicinities of Malubog Reservoir.
- *Uling Limestone*. Generally hard massive limestone; in part porous and coralline. It is exposed at top of ridges in the vicinities of Onggom Creek. It is middle Miocene in age.
- *Toledo Formation*. Thin to thick bedded sandstone and shale with occasional lenses of conglomeratic limestone and calcarenite. It conformably overlies the Uling Limestone. Total thickness is about 250m.
- *Carcar Formation*. It is dominantly massive to bedded coralline limestone, which is most widespread along the coastal areas of the island. It has a Plio-Pleistocene age.
- *Quaternary Alluvium*. Composed mostly of detrital deposits mostly sand and gravel in beaches, alluvial and riverbeds.

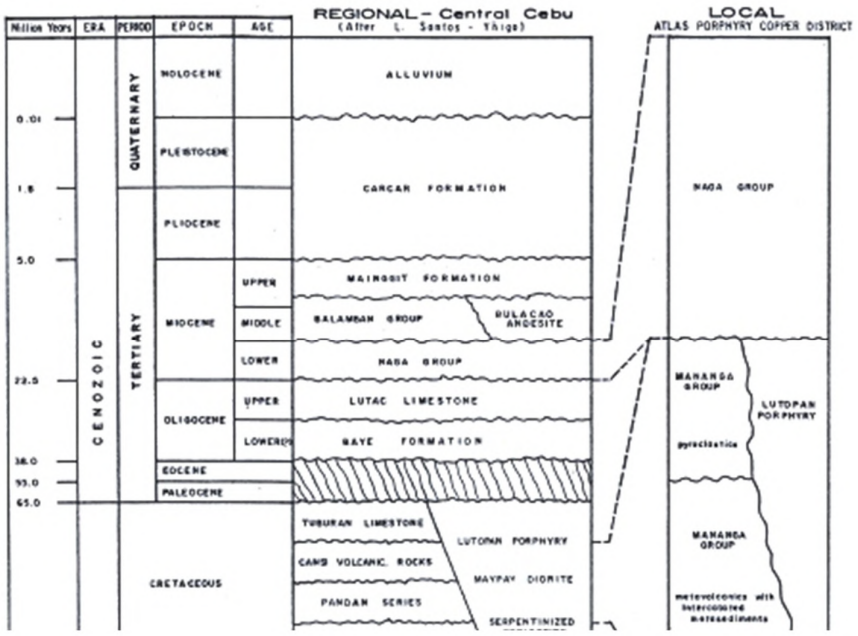


Figure 2.11 **Soil Stratigraphic Map**

Intrusive rocks that intruded the stratified rocks in the vicinities of project area include:

- *Bulacao Andesite.* Porphyritic andesite, partly intrusive breccia and partly extrusive with pyroclastics portions. It is exposed southwest of barangay Magdugo near Sapangdaku River. The age is possibly middle Miocene
- *Lutopan Diorite*. These intrusive rocks occur as quartz diorite stocks, dikes and occasional sills with dacitic to andesitic facies. The quartz diorite ranges from porphyritic to granitoid in texture with phenocrysts of zoned subhedral andesine rimmed with oligoclase, hornblende, biotite and quartz. K-Ar dating placed the diorite to be early Cretaceous in age.
- *Serpentinized Peridotite*. It occurs as diapiric lenticular bodies along principal fault zones.

Regional Tectonics. The evolution of Cebu Island involves complex tectonic events of which the typical mechanisms forming island arc magmatism and fore arc sedimentary basin development are the governing factors. The initiation of the evolution of island was postulated to commence sometime in the Mesozoic (*JICA-MMAJ, 1990*) through the collision between the Philippine Sea Plate and the Eurasian Plate. On the eastern boundary of the Philippine Arc, the collision is being absorbed and manifested by the East Luzon Trench-Philippine Trench. Consequently, the western boundary is marked by the eastward subduction of the generally north-south trending Manila-Negros-Cotabato Trench. Furthermore, the convergence is also being consumed within the arc itself as exemplified by the active sinistral Philippine Fault which transects the arc from north to south of the archipelago in a generally NNW trend (*Fig 4.2*).

Fig. 2.12 Tectonic Map of the Philippines

The complex geological development of Cebu Island is produced by periodic magmatism and forearc basin deposition. The prominent occurrences of the Mananga Group specifically in Central Cebu highlands can be probably correlated to the initiation of the postulated Zulu-Zamboanga- Masbate trench and arc systems, which occurred in the Cretaceous (*JICA-MMAJ, 1990*). Arc magmatism is believed active until Pliocene time. The development of the Visayan Sea Basin during Eocene-Pleistocene time provided a suitable environment and ample space for periodic deposition of the clastics and non-clastic units/formations. The latest episodic event of submarine deposition before the final stage of uplift is the building up of algal-reefal limestone of the Carcar Formation, which is presently fringing the entire Cebu Island.

Regional Structures. The prominent structural features in Cebu Island are the major northeast-southwest trending structural grain lineation, which are distinctly defined by nearly vertical fault system. These large-scale structures appeared to be correlative and parallel to the postulated Cretaceous-Pliocene northeast-southwest trending Sulu-Zamboanga-Masbate arc trench system (*JICA-MMAJ, 1990*)

Santos Ynigo (1951) has subdivided Cebu Island into three structurally distinct units namely: the Northern Highland Area, Central Highland Area and the Southern Highland Area. The principal fault systems bounding these areas are believed to have vertical movements early during the Cretaceous to Tertiary period but later exhibited left lateral strike slip movements. Block faulting specifically in Central Cebu Highlands has also been reported and plays a very important role in the emplacement of acid plutonic intrusives width associated metallization in portions. The Atlas mega-block is situated here.

Regional Seismicity. Active seismic generators of the Philippine Archipelago are associated with mobile belt boundaries specifically along convergent zones as exemplified by the East- Luzon-Philippine trench to the east and the Manila-Negros-Sulu-Cotabato trenches to the west where the Philippine Sea Plate and the Eurasian Plate are being consumed respectively. Furthermore, several active fault systems within the Philippine Arc itself more importantly the sinistral Philippine Fault systems are also active and even worst contributors to damaging earthquakes. The distribution and concentration of the destructive earthquakes in the Philippines as per past records showed that these are directly associated with active subduction zones and/or mobile fault zones. Recent study conducted jointly by PHIVOLCS and USGS had indicated that seismicity related with the subduction of the Philippine Sea Plate beneath the archipelago traces a west dipping Benioff zone to a depth of 150 km east of the Visayas but up to 700 km deep east and south of Mindanao.

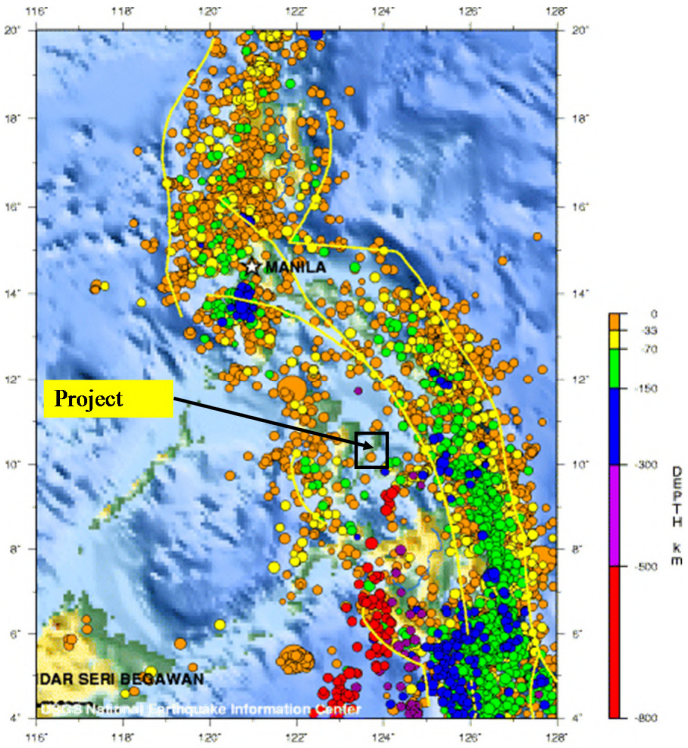


Fig.2.13 **Seismicity Map Of The Philippines, 1990-2001**

Cebu Island being geographically located distal from the primary earthquake generators as explained above has the least chances of experiencing major and destructive earthquakes, as exemplified by the earthquake frequency distribution in the Philippines done by PHILVOLCS (*Fig. 3.12*). Thus the low number of recorded earthquakes in the island of Cebu also suggests low seismicity or seismic activity level in the project area.

Mine Site Geology. The porphyry copper deposit of the Atlas Mines is confined within a 3 to 4 kilometer-wide ENE-trending fault block bounded by two steeply dipping mega-shears – the North Barot Fault to the north and the Cantabaco Fault to the south (*Fig*. 3.13). Within this fault block, four known major ore bodies exist, namely: Lutopan, Carmen, Biga and Odlum. The mineralization is located along en-echelon structures trending NNE-SSW (*Reyes, et.al, 1984)*

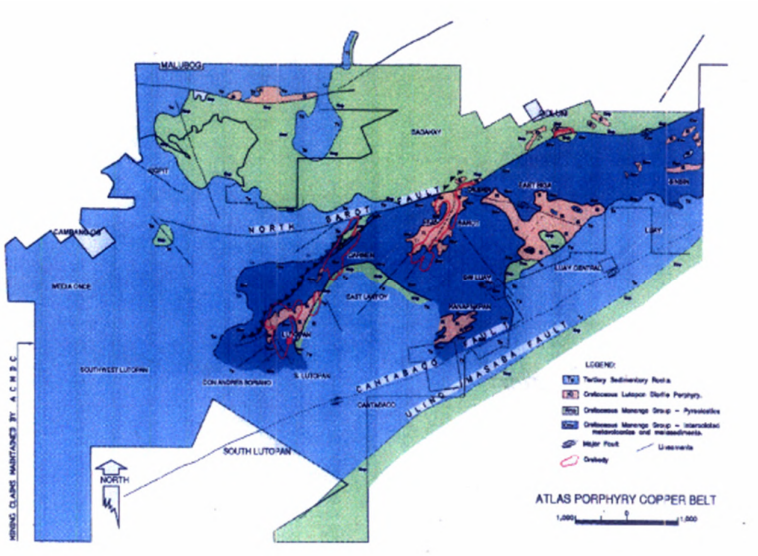


Figure 2.14 **Geologic Map of Atlas Mining District**

This Atlas Block is a horst possibly tilted southwest and has been traced for about twenty kilometers. The Atlas Block is further contained within a bigger graben block (Uling-Maypay Block) bounded by the Uling-Masaba Fault in the SE and the Maypay Fault in the NW.

The North Barot Fault is one of the two (2) mega shears controlling the copper mineralization of the Atlas District. Fault zone ranges from 0.30m. gouge to 130m wide fault zone. This fault is believed to have cut the northern tips of Carmen and Greater Biga orebodies which resulted in a 1.5 to 2 km right lateral displacement to form the Crusher and Odlum satellite orebodies.

Mineralization of the primary copper deposit is hosted by the intrusive Lutopan quartz diorite and the adjacent altered metasediments of the Pandan Formation and the metavolcanics of the Cansi Formation. The mineralized basement rocks are unconformably overlain by the Tertiary group of sediments locally named as the Naga Group. These include the Cebu Formation and the Malubog Formation.

Ore minerals are mainly pyrite, molybdenite, chalcopyrite and magnetite with minor amount of bornite, sphalerite, hematite, anhydrite, quartz, calcite and gypsum. Chalcopyrite and minor bornite occur as veinlets to stockworks, as dessiminations and clusters, concomitant with silicic alteration (*Reyes, A.N., et.al., 1984*).

Mineralization. The intrusive quartz diorite and the adjacent metavolcanics and metasedimentary rocks of the Mananga Group Formation host the primary copper mineralization of the Atlas Mines. Chalcopyrite and minor bornite occur as veinlets to stockworks, as disseminations and clusters, associated with silicic alteration.

The relative abundance of the sulfides in the copper deposits in decreasing order is as follows: pyrite, chalcopyrite, bornite, molybdenite and sphalerite. Pyrite is widespread in all zones but is most abundant in the phyllic zone.

Gold and silver are minor in composition, averaging 0.23 g/DMT and 2.05 g/DMT respectively. Generally gold and silver mineralization is not statistically correlated with the distribution of copper values. Instead, the Au and Ag are spatially associated with quartz stockworks and quartz replacement and magnetite.

An Atlas Mines official indicated that, *"preliminary reconnaissance and exploration in the past did not indicate potential copper mineralization within the Sigpit valley."*

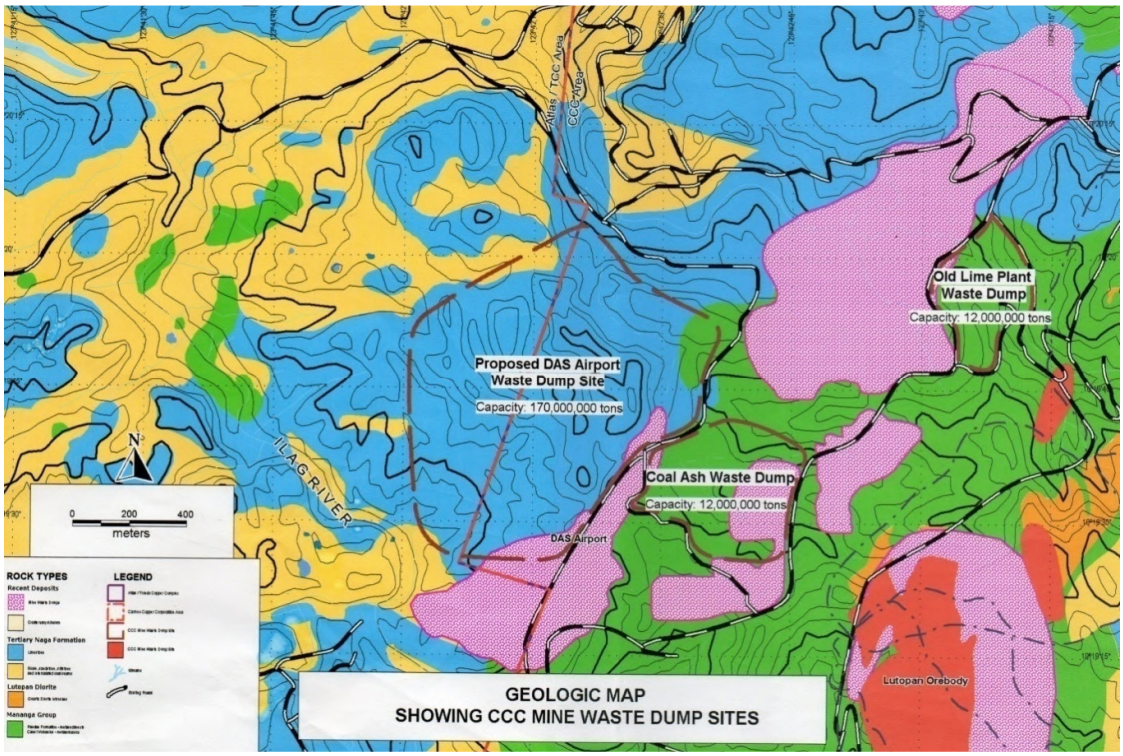


Figure 2.15. **Geologic Map of Proposed DAS Airstrip WRD and Surrounding Areas**

2.1.2.2 Change in Surface Landform/Geomorphology/Topography/Terrain/Slope

The general topography/terrain of Toledo City is predominantly rugged as 60% of the total land area has a slope of above 18%, while the remaining 40% is below the 18% slope. Brgy. DAS where the Atlas Mines is generally located, has 77% of its total land area of 1,760 hectares comprised of 18% slope and above.

The significant impacts to surface landform/topography/terrain/slope is the removal of overburden and ore extraction in an open pit mining and the deposition of wastes

The Maunsell Study described the Atlas Mine Landforms as follows: *"The proportion of the total mine lease area occupied by natural landforms is comparatively small and most of the land has been used for mining related purposes. Land not used directly for mining, mineral processing, or other infrastructure is occupied by permanent waste rock dumps. Except for the steepest hillsides, the small proportion of land that has not been used for mining related purposes has been cleared and is being used for agriculture. The landforms within the mine lease area are dominated by the waste dumps and the open cut pits. Associated with these major landforms are subsidiary landforms such as alluvial outwash fans. Some major landforms were created in constructing the mine infrastructure including, for example the major fills for the runways."*

A large part of the mine area consists of apparently unstructured waste rock dumps (WRDs) associated with the pits that have been mined. The names of these dumps are: Khyber pass, Carmen, Carmen North, Lutopan, Biga West, Biga East, and Odlum WRD. In addition there are some constructed fills

which are also generally identified as waste dumps and these are the Airstrip, Old Airstrip and Recreation dumps.

Waste rock has also been deposited within the DAS Pit above the Lutopan underground workings as subsidence fill. The purpose of this fill was to replace ground that would have subsided as the DAS Lift No. 2 block caving operation was completed.

Waste dumps were mostly constructed by end dumping from trucks and dozing. In the case of the Biga East WRD, a conveyor system transported the waste to the dumps because of the long haul distances involved. The dump face angles were mainly at angles of repose in the range of 32 to 35°. The shallower angles are lower than the angle of repose for many hard rock materials and may reflect the presence of significant proportions of dispersive clays within the WRDs and the hydrological conditions under which the dumps were formed and have continued to be exposed.

Most of the dumps are simple valley fill dumps and have continuous angle of repose slopes heights estimated to be generally in the range of 50 to 80 m but occasionally in excess of 100 meters. The pre-existing topography and hydrology is unknown and it is not known what fi any site preparation was carried out before dumping was begun in a new area. However in steep tropical gullies this is likely t have been impractical and waste was probably dumped directly over the vegetation and soil. Ironically, this may enhance the stability of the dumps in the short term as the vegetative mat comprising well-rooted mature trees can provide reinforcement to the base of the dump until the vegetation rots.

While the dumps appeared stable, it is not possible to predict their future behavior. As the tragic failure of the coal waste dump in Aberfan in Wales showed, it may take up to a hundred years or more for the consequences of bad dump design to result in a mass failure.

In the case of the Biga East Dump it is understood that these were designed to have a factor of Safety (FOS) of 1.2 with 50% saturation. The dumps were constructed with a maximum lift height of 30 meters. A bench separated each lift. The result is a topography that consisted of a series of stepped smaller dumps which made up a larger dump area in which the overall slope angles were much flatter than the dumps around the lime kiln for example. Even accepting that the Biga East Dump is much younger than the dumps around the lime kiln, it can be seen that the waste dumps at the lime kiln were much more eroded than at Biga East. This pattern of severe erosion was repeated to a varying extent in all of the dumps where the height exceeded 50 meters and where there were no intermediate benches.

Slope and slope development. All of the WRDs were constructed by top down deposition. Waste was either dumped and dozed or was discharged from a conveyor so that it was deposited down slope from the point of discharge. Under these conditions, the soil and rock fragments come to rest at their angle of repose, typically at a gradient of about 75%. The loose soil surfaces formed in this way are highly susceptible to erosion by surface run-off; waste dump slopes that have been exposed to a number of cycles of erosion begin to display a sigmoidal shape as material is washed down the slope from the crest to the toe. Where suitable vegetation has been established, the rate of erosion and thus shape change of the slopes is much less marked, as shown by the rehabilitated northern slopes of the Carmen WRD.

Development of the steep slopes on the WRDs is also controlled by the properties of the fine fraction. Thus, the vegetated slopes around the lime kiln area are still eroding because fo the inferred presence of dispersive clays in the fines fraction. In contrast the coarser fines in the Biga East WRD tend to develop a mineralized crust, particularly, during the dry season that protects the surface from erosion.

As a result of the mode of formation, segregation by particle size piping is a less common but still significant source of erosion in the waste dumps, caused by water moving at relatively high velocities through coarse, permeable bands bound by finer grained, less permeable strata. It occurs more commonly east of the DFL

Flats. Most of the WRDs have a level top as a result of bulldozers pushing out the waste to the dump crest. The WRD flats should be constructed with a slight grade back from the crest and with a bund at the crest. The purpose of the grade away from the crest is to keep water from spilling over the crest and eroding it and to keep the face of the dump as dry as possible so as to minimize the inclusion of water softened zones. The bund is a safety device to indicate to drivers reversing their trucks when to stop and dump their load before getting too close to the crest of the dump. The bunds also serve to prevent water spilling over the crest to the dump should the surface dip towards the crest.

For the most part the crest bunds were absent from the dumps of the Atlas Mine. And, at some of the dumps the drainage had been reversed because of self-weight settlement of the dump materials. As a dump crest extends out into a valley the waste thickness increases so that while the percentage settlement may remain approximately constant the total amount of settlement increases.

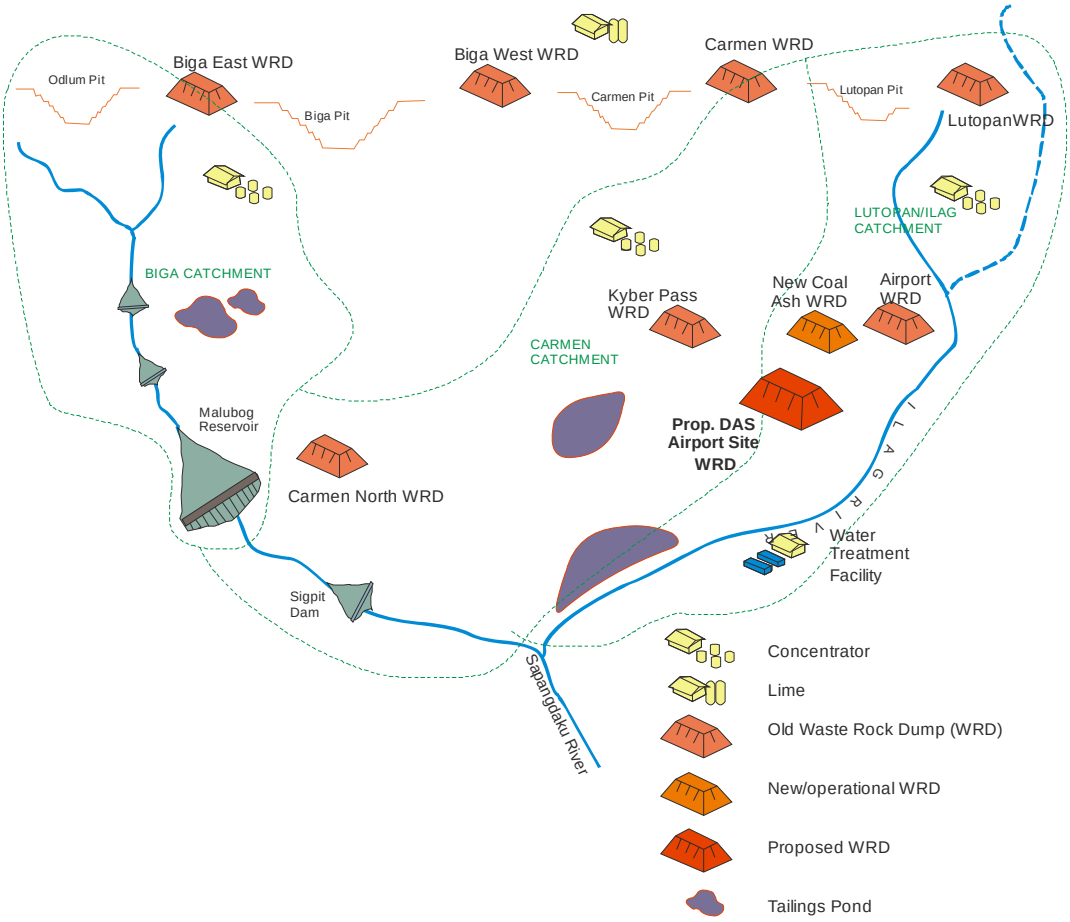


Figure 2.16 **Atlas Mines WRD Sites and Catchment Area**

2.1.2.3 Change in Sub-Surface/Underground Conditions

Atlas Mines had previously undertaken underground mining/extraction of ore, but this was discontinued and the underground mines were sealed. The current surface open-mining and other activities within the mine-site do not influences underground condtions

2.1.2.4 Hazards - Inducement of Subsidence, landslides, mud/debris flow, etc.

2.1.2.4.1 Geologic Hazards at the Minesite[10]

Geologic hazards include all hazards entirely or partly caused by processes that take place in the subsurface of the earth, They are further classified into seismic, mass movement, and volcanic hazards. Hydrologic hazards on the other hand are classified in fluvial for those generated by processes on-land, and coastal for those occurring at the sea interface.

Seismic Hazards. Seismic hazards, associated with the presence of fault structures, are the intrinsic natural occurrences of earthquakes and the resulting ground motion and other effects. In seismology, risk may be defined as the probability of earthquakes with a certain magnitude to cause a disturbance in a region during a specific period.

Localities, differing in ground composition, ten to have varying seismic influences relative to other areas. Soft soil (including clay and silty materials) absorbs higher seismic energy relative to hard soil, including crystallized materials

Previous mapping of the area reveals that Carmen Copper Corporation (TCM) has faults. These are North Barot Fault, Cantabaco Fault, Northeast Fault, and the Carmen Thrust Fault.

Mapping conduced by Mine Geology near the Repeater Tower also reveals a minor fault.

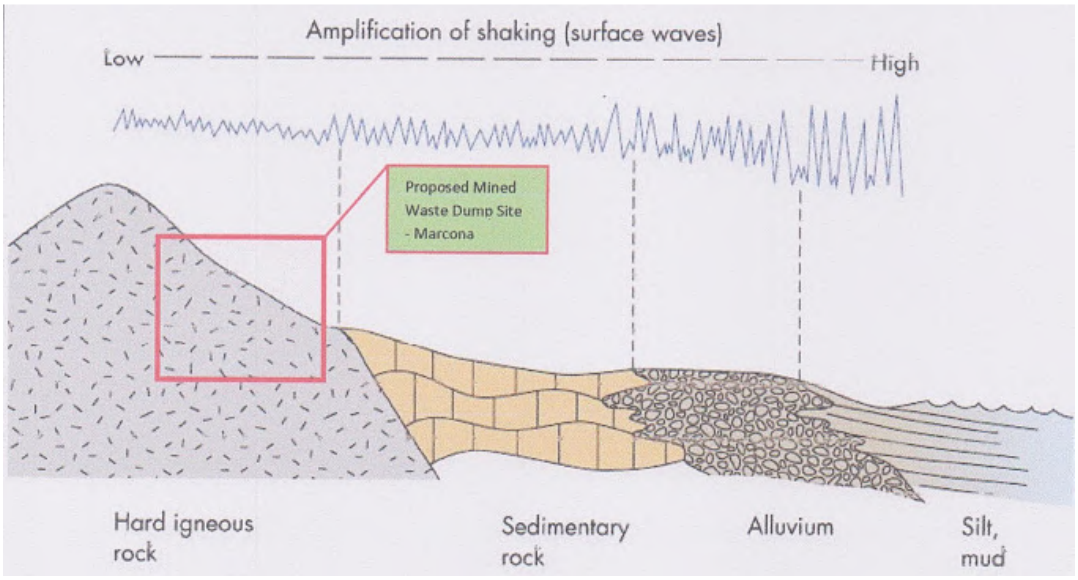


Figure 2.17 Generalized Relationship between the near-surface Earth Materials and Amplifications of Shaking During a Seismic Event. (Source: EGGAR)

Ground Acceleration. An advance in ground motion caused by earthquakes may result to great damage and destruction to property and infrastructure accompanied by loss of life. The influence of underlying osil on the local amplification of earthquake shaking is called the site effect Factors that influence the intensity of ground shaking include the magnitude of the earthquake, distance of the site

[10] Panday, J. (2018). Engineering Geological and Geohazard Assessment Report for the Proposed Mined Waste Dump Site at Marcona. Carmen Copper Corporation.

in relation to the earthquake generator, characteristics of the underlying rocks, and soundness of the infrastructure.

The Philippines, owing to its tectonic setting has been generally considered as a seismic hazard country by various local and international studies that includes the PHIVOLS, DENR, Manila Observatory, Global Seismic Hazard Assessment Program (GSHAP), and the United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA)

Ground Rupture. Involves ground movement along one side of a fault relative to the other, caused by an earthquake. This geological hazard exists in the area due to the existence of fault structures at CCCs compound.

Rockfall. Fall of earth material, either gravitational or mechanical, from an elevated ground. This geological hazard exists in the area because the proposed location is situated in an elevated ground.

Fault Creep. This geological hazard exists in the area as discussed in 'ground rupture'

Lateral Spread. Lateral spread or flow are terms referring to landslides that commonly form on gentle slopes and that have rapid fluid-like flow movement, like water. This geological hazard exists a sthe the area is in a gentle to steep slope.

Tsunami. A large wave on the ocean or sea, usually caused by an undersea earthquake, a volcanic eruption or coastal. A tsunami can travel hundreds of kilometers over the opne sea and cause extensive damage when it encounters land. This geological does not exist in the area *(minesite), but the port area is at risk being in the coastal zone.*

Seiches. An oscillation of the surface of a landlocked body of water (as a lake) that varies in period from a few minutes to several hours. This geological hazard does not exist in the area.

2.1.2.4.2 Mass Movement Hazards

A geomorphic process by which earth materials move downslope, either continuously or discontinuously under the influence of gravity. This group of geological hazard exists in the area (TCM minesite)

2.1.2.4.3 Volcanic Hazards.

Risk caused by volcanic process. Cebu Island has no surrounding potentially active and active volcanoes.

2.1.2.4.4 Hydrologic Hazards

Hazards caused by processes involving surface flow of water are classified as hydrologic hazards. The assessment of these types of hazards requires evaluating other natural phenomenon such as meteorological disturbances. Considered parameters include typhoon paths, monsoons and precipitation data.

Fluvial Hazards. Hazards induced by surface water processes occurring along inland waterways, either natural (such as rivers, streams and gullies), or man-made (such as floodways, canals, and other pre-designed drainage systems). Factors affecting the hazards in a fluvial setting include flood overflow, sheet flow, riverbed scouring, channel erosion and migration, rill and gully erosion. There is a minor susceptibility to flooding due to a creek transecting the project area.

Coastal Hazards. Surface water processes occurring at and near (about 200 m offshore and onshore) the coastline. These include coastal flooding, erosion, aggradation, storm surges and near coast

submarine landslides. Sea level changes have recently been studied especially in areas where uplift and subsidence rates appear to be too raid to explained along by sea level changes established from wordwide observations, In the Philippines, such rapid processes may be explained in terms of sea level changes combine with fast tectonic vertical movements such as those occurring near subduction and collision zone.

Table 2.7 Summary of Potential Geohazards Existing in Project Area

Hazards			Risks	Remarks
Geologic Hazards	Seismic Hazards	Ground Acceleration	Yes	Central Cebu Fault System transects Toledo City
		Ground Rupture	Yes	Mapped Faults in CCC Compound
		Rock fall	yes	Project Area is located in an elevated area
		Fault Creep	yes	To a certain degree similar to ground rupture
		Lateral Spread	yes	Project Area is located in an elevated area
		Tsunami	none	Minesite is far from the coastal area
		Seiches	None	Project Area is located in an elevated area
	Mass Movement	Landslide	Yes	Project Area is located in an elevated area
		Creeps	Yes	
		Subsidence	Yes	
		Settlement	yes	
	Volcanic Hazards	Lava flow, debris flow, pyroclastic flow, lahar, etc.	None	Cebu island has no active and potentially active volcanoes
Hydrologic Hazards	Fluvial Hazards	Flooding	Yes	Minor susceptibility to flooding due to a creek which transects the project area
		Scouring of the Riverbed	None	Only a creek is seen in the project area
		Channel erosion and migration	none	No major drainage system within and/or near the immediate vicinity
		Rill Erosion	yes	Rill erosion may occur
		Gully Erosion	Yes	Gully erosion may occure
		Sedimentation	None	
	Coastal Hazards	Flooding, coastal erosion, storm surge, etc.	None	

Seismic Hazard is the most evident or existent geohazard that may affect the proposed mine waste dump site as the project area is situated in an elevated area with moderate to steep slope. Furthermore, the Central Cebu Fault System transecting Toledo City has the potential to initiate any risk caused in the locality.

Hence, it is recommended that proper benching and drainage be followed. Considering that this is a stockpile site, slope angle should be 30°. Ground saturation should also be considered as a creek transects the proposed location and dam is found near the project area.

2.1.2.4.5 Geologic Hazards at the Port Area

The hazard assessment reports by hazardhunterph for the CCC port area indicated the following:

Table 2.8 Hazards Assessment Results for the CCC Port Area
(Source: (https://api.georisk.gov.ph/api/reports/hazard-assessments/123.63824/10.38866)

		Assessment	Explanation & Recommendation
Seismic	Ground Rupture	Safe; Approximately 10.8 km west of the Cebu Fault System: Central Cebu Fault	Active faults are faults that have moved within the last 10,000 years. An active fault may show evidence or may have documented history of recent movements. Ground rupture is a displacement along an active fault trace that reaches the surface. Ground rupture hazard assessment is the distance to the nearest known active fault. The recommended buffer zone, or Zone of Avoidance, against ground rupture hazard is at least 5 meters on both sides of the active fault or from its zone of deformation.
	Ground Shaking	Prone; Intensity VIII	All sites may be affected by ground shaking in the event of an earthquake and can be mitigated by following the provisions of the National Building code and the Structural code of the Philippines.
	Liquefaction	Highly Susceptible	Liquefaction is a phenomenon wherein the ground, especially near the river, lake and coasts, behaves like liquid similar to quicksand due to very strong shaking. Liquefaction hazards can be mitigated by following the provisions of the National Building Code and the Structural Code of the Philippines.
	Earthquake-Induced Landslide	Safe	Earthquake-induced landslides are the downward slope movement of rocks, solid and other debris commonly triggered by strong shaking.
	Tsunami	Safe	A tsunami is a series of sea waves commonly generated by under-the-sea earthquakes
Hydro-Meteorological	Flood	Most likely suitable for development, needs further validation	The implementation of appropriate mitigation measures as deemed necessary by project engineers and LGU building officials is recommended for areas that are susceptible to various flood depths. Sitespecific studies including the assessment for other types of hazards should also be conducted to address potential foundation problems
	Storm Surge	Data are being updated	A storm surge ("daluyong ng bagyo") is the abnormal rise in sea level that occurs during tropical cyclones or "bagyo". It happens when a very strong tropical cyclone blows-off excessive amounts of seawater toward low-lying coastal communities. It is catastrophic and life-threatening because a storm surge can cause massive inland flooding, sometimes in unimaginable heights. It is even more dangerous when the storm surge coincides with a high tide. For storm surge-prone communities, the most important considerations are 1) the strength of the tropical cyclone, 2) the height of the surge, and 3) if the community is located in a low-lying areas
	Severe Wind	117.1 - 220 kph (20- year return period); 117.1 - 220 kph (500- year return period)	The Regional Severe Wind Hazard Map represents the 3-second peak gust wind speed measured at 10-meter height (above ground) over open and flat terrain. This does not take into account the local factors such as topography, terrain roughness and shielding from neighbouring structures. The Regional Severe Wind Hazard is expressed in terms of Return Periods (RPs) of Tropical Cyclone winds. Return period means the repeat interval, or the estimate of likelihood and severity of severe wind event. Return periods are then translated into Annual Exceedance Probabilities (AEPs) which are the chance that a given severe wind hazard level will be equalled or exceeded in any year. At higher return periods, the wind speeds are stronger but are less frequent.

			At lower return periods, the wind speeds are less intense but are more frequent. The Regional severe wind hazard maps are used to update the wind zoning map of the Philippines and as reference in designing building structures. For those areas identified as high risk to wind damage, building codes/regulations must be strictly implemented to mitigate severe wind risks. For already developed areas, retrofitting is encouraged – the methods applied in this study can be used to set out a cost-benefit study for retrofitting older, more vulnerable building types to increase their resilience to severe winds

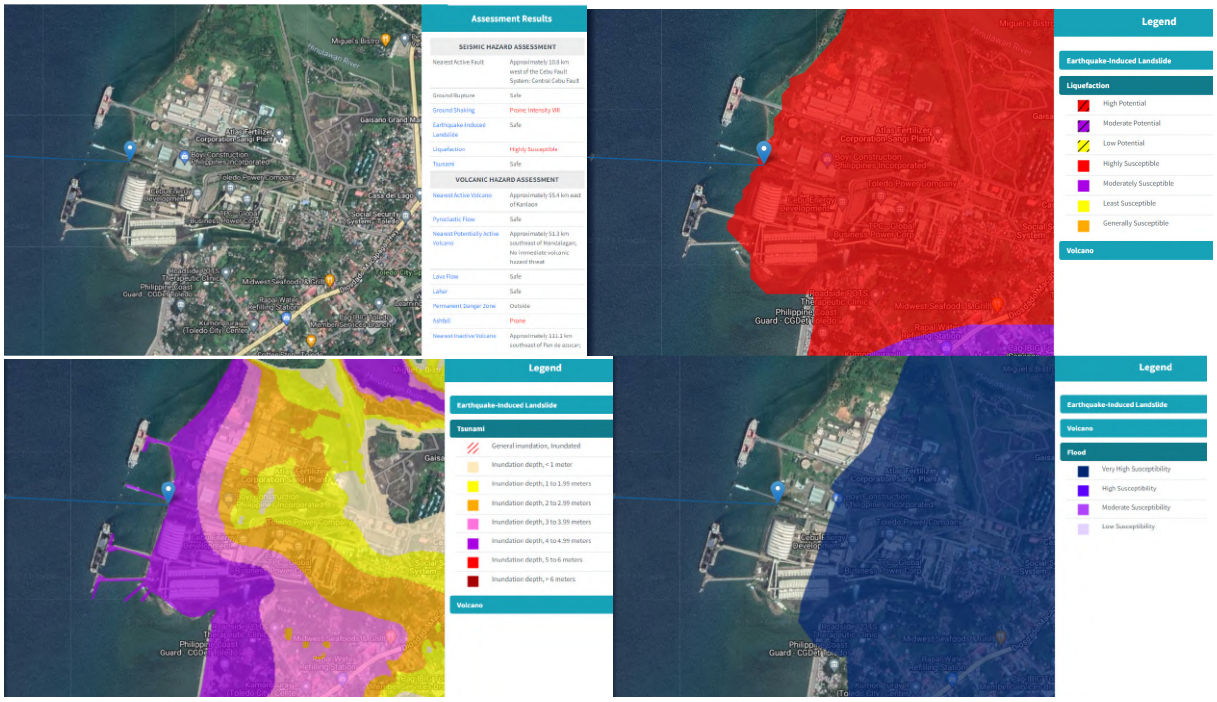


Figure 2.18 Seismic, Volcanic and Hydro-Meteorological Hazard Maps of CCC Port Area (source: https://hazardhunter.georisk.gov.ph/map#)

2.1.3 Pedology

2.1.3.1 Soil Erosion/Loss of Topsoil/Overburden

Soil Type[11]. The entire area of Toledo City is composed of six soil type, namely: 1) Baguio Clay Loam, 2) Mantalungon Clay Loam, 3) Faraon Clay, Steep Phase, 4) Lugo Clay, Mandaue Silt Loam and Hydrosol (Figure 3.4 Soil map of Toledo City). Most of these soil types are found in the TCM minesite.

[11] CCC (2011). Atlas Mines Tailings Disposal Facility Amendment

The Mantalongon Clay Loam type of soil is formed from the sedimentary materials of shale and sandstone. The slope ranges from over 8% and can be found in any elevation over 100 meters. Erosion is moderate to severe, well drained with solum depth ranging from 20-60 cm, and it is getting shallower as the elevation increases. This soil type is extensively grassland and brushes. Agricultural cop grown include corn, vegetables, root crops, banana, coconut and mango trees.

Faraon Clay Steep Phase soils have developed from limestone. Usually found in slope ranges of 50 to 50%, undulating to rolling, hilly to mountainous relief, The Faraon series is typified by exposed limestone rock outcrops and denuded hilly to mountainous landscape. Soil color is dark grayish-brown. The common vegetative cover is mostly grasses, shrubs, coconut, corn, and sporadic patches of fruit trees, as well as, second growth forest species.

Mandaue soil is geologically recent depositions of alluvial materials or sediments, which have been eroded and transported downhill and downstream. They can be generally found in areas below 100 meter elevation and within a slope range of 0-5% slope. The Mandaue clay loam or silt loam are moderately to poorly drained. The solum deep is about 100 cm deep, and free from boulders and larger stones, thus can allow deep plowing. The soil is rich is organic matter (2.0-2.9%) and fertile. Erosion is only slight. Talahib, Cogon and bamboo groove make-up the main vegetation of areas with this type of soil.

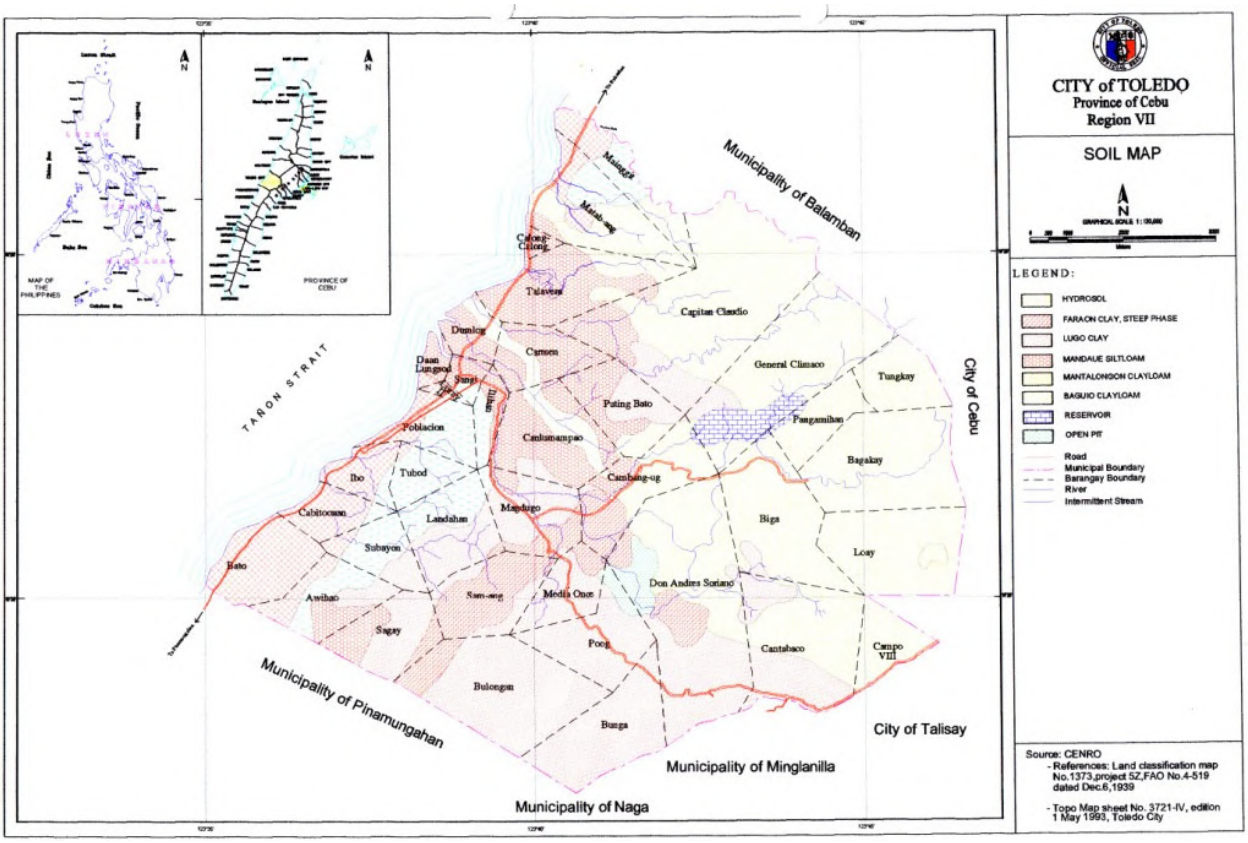


Figure 2.19 Soil map of Toledo City, Cebu

Soil Erosion and Sedimentation[12]

Because of the large area of land disturbed by mining operations and the large quantities of earthen materials exposed at sites, erosion can be a major concern at the *Atlas Mines* . The potential of soil and sediment eroding into and degrading the Atlas Mines network of rivers and creeks (sp. Sigpit River) down to Sapangdaku and ultimately the coastal areas of Toledo City could pose a serious problem. An European Union Study, cited in ELAW (July 2010)[13], noted the following:

"Erosion control must be considered from the beginning of operations through completion of reclamation. Erosion may cause significant loading of sediments (and any entrained chemical pollutants) to nearby waterbodies, especially during severe storm events [heavy precipitation].

"Sediment-laden surface runoff typically originates as sheet flow and collects in rills, natural channels or gullies, or artificial conveyances. The ultimate deposition of the sediment may occur in surface waters or it may be deposited within the floodplains of a stream valley. Historically, erosion and sedimentation processes have caused the build-up of thick layers of mineral fines and sediment within regional flood plains and the alteration of aquatic habitat and the loss of storage capacity within surface waters. The main factors influencing erosion includes the volume and velocity of runoff from precipitation events, the rate of precipitation infiltration downward through the soil, the amount of vegetative cover, the slope length or the distance from the point of origin of overland flow to the point where deposition begins, and operational erosion control structures.

"Major sources of erosion/sediment loading at mining sites can include open pit areas, heap and dump leaches, waste rock and overburden piles, tailings piles and dams, haul roads and access roads, ore stockpiles, vehicle and equipment maintenance areas, exploration areas, and reclamation areas. A further concern is that exposed materials from mining operations (mine workings, wastes, contaminated soils, etc.) may contribute sediments with chemical pollutants, principally heavy metals. The variability in natural site conditions (e.g., geology, vegetation ,topography, climate, and proximity to and characteristics of surface waters), combined with significant differences in the quantities and characteristics of exposed materials at mines, preclude any generalisation of the quantities and characteristics of sediment loading.

"The types of impacts associated with erosion and sedimentation are numerous, typically producing both short-term and longterm impacts. In surface waters, elevated concentrations of particulate matter in the water column can produce both chronic and acute toxic effects in fish.

"Sediments deposited in layers in flood plains or terrestrial ecosystems can produce many impacts associated with surface waters, ground water, and terrestrial ecosystems. Minerals associated with deposited sediments may depress the pH of surface runoff thereby mobilising heavy metals that can infiltrate into the surrounding subsoil or can be carried away to nearby surface waters. The associated impacts could include substantial pH depression or metals loading to surface waters and/or persistent contamination of ground water sources. Contaminated sediments may also lower the pH of soils to the extent that vegetation and suitable habitat are lost.

"Beyond the potential for pollutant impacts on human and aquatic life, there are potential physical impacts associated with the increased runoff velocities and volumes from new land disturbance activities. Increased velocities and volumes can lead to downstream flooding, scouring of stream channels, and structural damage to bridge footings and culvert entries.

In areas where air emissions have deposited acidic particles and the native vegetation has been destroyed, runoff has the potential to increase the rate of erosion and lead to removal of soil from

[12] Singh (2007) as cited in CCC (2011). Atlas Mines Tailings Disposal Facility Amendment
[13] Environmental Law Alliance Worldwide (July 2010).

the affected area. This is particularly true where the landscape is characterised by steep and rocky slopes. Once the soils have been removed, it is difficult for the slope to be revegetated either naturally or with human assistance."

Environment Australia summarizes the problem as follows:
"Potentially adverse effects of inadequate minesite water management and design include: unacceptably high levels of suspended solids (Non-Filterable Residue) and dissolved solids (Filterable Residue) in surface runoff [and] bed and bank erosion in waterways. It is self-evident that a Sediment and Erosion Control Plan is a fundamental component of a Minesite Water Management Plan."

The effects of previous Atlas Mines operations, such as the submarine tailings disposal practiced from 1971 to 1991 has been recognized, in fact this has resulted to the issuance of Executive Order No. 96 "Creating the Atlas Commission" by then President Gloria Macapagal-Arroyo in 2002. The 'Commission (Tanon Strait Commission)' tasked the Maunsell Philippines, Inc. to conduct the environmental assessment and engineering feasibility study.

The Maunsell Study, noted in its "Freshwater, Seawater, Riverine and Marine Sediment Quality" findings the following:

"The largest impact on the quality of the Sapangdaku River is from the input of mine site drainage at Sigpit Creek. The pH and alkalinity of the waters downstream from this point exhibit a sharp reduction from background values as the alkalinity is consumed by acidic mine runoff. Recovery towards natural values then occurs, likely driven by further dilution from naturally alkaline tributaries. In terms of both water and sediment quality, the lower Ilag River responds favourably to wet season flushing. It also noted the exceedance of relevant environmental guideline levels in the River systems and into the nearshore coastal waters of the Tañon Strait. No seawater samples exceeded the relevant water quality guidelines during the wet season."

2.1.3.2 Change in Soil Quality/Fertility

Soil Fertility. To determine the soil fertility status of the of the project area (Oggom creek) a soil survey was conducted on 9 November 2006. Three samples were taken from the stream/creek. The first sample was taken about 0.5 to 1.0 km below the head water and about 50 to 70 meters from the location of the proposed outfall/drainage area of the three (3) by-passed Tunnels from the Malubog Dam. The second sample was taken approximately about 30 meters away from the middle axis of the stream, while the last sample was collected from the side slope about 30 meters away from the Spill Way and about 2 km or more towards the convergence area at *Sapang Dako.*

Figure 3.5 below shows the approximate location of the soil sampling area. The locations were taken using the Geographic Position System (GPS) technology and was plotted using Geographic Information System (GIS) Software using the Topographic Map of NAMRIA with a scale of 1:50,000. On the other hand, detailed discussions of the soil fertility status are discussed under the Section 3.2.1.4.5 Results of the Soil Laboratory Analysis.

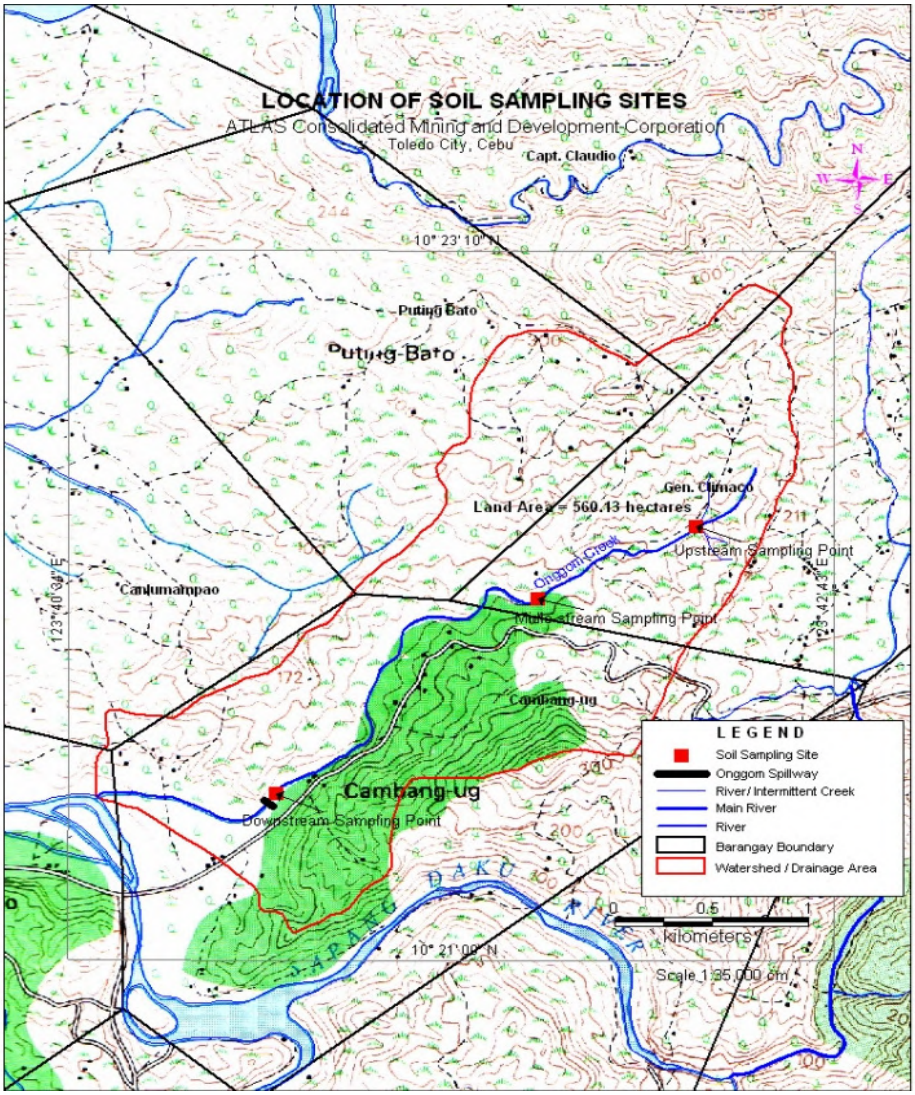


Figure 2.20 Location of Soil Sampling Sites

Laboratory Results of Soil Sample Analysis. To determine the soil fertility status of the area in question (*Onggom* Creek), a soil laboratory analysis is needed using selected chemical properties of the soil as parameters. These are the organic matter (OM) content of the soil expressed in percent; the level of phosphorous (P) expressed in parts per million (ppm); the level of potassium (K) also expressed in parts per million and the soil pH which is a measure of the degree of acidity or alkalinity. For the soil physical property, only the soil texture is included. In summary, the three soil chemical properties, namely: OM, P and K are the main determinants in determining the fertility status of the soil, since these elements are the three major elements among the 16 or more elements present in soil (including micro and trace elements) that are needed by the plants to sustain and perpetuate plant growth.

Organic Matter (OM). Organic matter (OM) content of the soil measures the relative abundance or deficiency of organic matter content in the soil needed for plant growth. The amount of organic matter present in a soil is normally expressed as a percentage of the oven-

dry weight of the soil. Most soils contains between 1 and 6 percent organic matter. This represents between 20,000 and 120,000 kg of organic matter in an average hectare-furrow slice (about 2 million kg of soil) (Thomson and Troeh 1978: 109-110). Therefore, a soil to be considered abundant in OM should have at least 20,000 kg per hectare.

Results of the laboratory test (Table 3.1) revealed that the OM contents of the three samples range between 3.0 to 3.5 percent. Sample No. 1 and 2 have identical results of 3.0 percent while Sample No. 3 has the highest OM content compared with the other two samples. In general, laboratory test results indicate that the soil in the project area represented by its samples is still relatively high in OM/nitrogen content which is capable of sustaining healthy plant growth assuming all other factors are favorable such as soil moisture, temperature, humidity or the weather in general and several others.

Phosphorous (P). Phosphorous (P) has been called 'the key to life" because it is directly involved in most life processes. It occurs in the soil in both inorganic and organic forms. Phosphorous that is discussed in this report refers to the organic form. An entire hectare-furrow slice generally contains less than 1 kg of phosphorous in solution (out of the total phosphorous content of about 1,000 kg). However, the amount of phosphorous in the soils depends considerably on both climate and parent material but rarely exceeds 0.3 percent (Thompson & Troeh 1978: 259-274). However, soil test result in this report is measured in parts per million (ppm) with the percent transmitant scale between 0 to 100. 100 being the highest and 0 being the lowest.

Results of the laboratory test (Table 3.1) showed that the phosphorous content of the three samples range from 40 to 44 ppm. Sample No. 1 and 3 have identical results of 40 ppm each, while Sample No. 3 has the highest P content with 44 ppm. Further, results indicated that all the phosphorous nutrient level in the soil as shown by the samples have not even reach the 50 percent level (percent transmitant), therefore, the soil in the project area is deficient in phosphorous. Nevertheless, it is capable of sustaining plant growth assuming all other factors are favorable such as soil moisture, temperature, humidity and several other factors.

Potassium (K). Potassium (K) in the soil occurs as potassium ion in mineral structures and as hydrated potassium ions either in solution or adsorbed on cation-exchange sites. An average hectare furrow slice contains approximately 30,000 kg of potassium. Exchangeable potassium usually constitutes between 100 and 400 kg of potassium hectare-furrow slice and dissolved potassium in the soil solution is nearly always less than 5 kg per hectare-furrow slice. The non-exchangeable potassium is probably about 99 percent of the total, and the potassium in solution usually constitutes only about 0.01 percent or less of the total potassium in the soil (Thompson & Troeh 1978: 283-285).

Results of the laboratory test (Table 3.1) showed that the potassium content of the three samples were all **deficient**. Meaning the available exchangeable potassium in the soil cannot fully support the potassium nutrient needed by the plants which is very essential to their growth. To off-set this deficiency there is therefore a need to add in-organic source of potassium into the soil.

Note: Potassium laboratory test was done using Soil Test Kit (STK) because at the time soil samples were submitted for laboratory analysis, the instrument was still not functional.

pH. The per hydroxyl ion which is most popularly known as pH is closely related to the relative amounts of acidic cations (M^{+} and Al^{+++}) and bases on its cation-exchange sites or simply as a measure of the degree of acidity and alkalinity in a soil solution. pH is one of the major limiting factors or determinant for plant growth. .

As shown in Table 3.1, Sample No. 1 has a pH value of 7.47 which is above the neutral value of pH of 7. This means soils in this area are alkaline. In contrast, the other two (2) samples with pH values of 5.15 and 6.24 respectively are slightly acidic to acidic.

Table 2.9 Results of Soil Sample Analysis at Onggom Creek, November 2006.

Parameters	**Sample Site No. 1**	**Sample Site No. 2**	**Sample Site No. 3**
Location	Up-Stream	Middle-Stream	Lower-Stream
North Latitude	10° 22’ 16.98”	10° 22” 0.18”	10° 21’ 25.92”
East Longitude	123° 42’ 30.42”	123° 41’ 56.88”	123° 41’ 12.42”
Field Texture	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam
OM%	3.0	3.0	3.5
P (ppm)	40	44	40
K (ppm)	Deficient	Deficient	Deficient
Soil pH	7.47	5.15	6.24

Soil Sampling[14]. The Atlas Baseline Study (CGK, 2007-2008) obtained sixteen soil samples taken randomly from the around the Toledo Copper Mine site (see Fig. 4.9). Sampling points within or near the project affected areas are basically, areas that will be traversed by the propose overflow pipeline.

Table 2.10 Metal and Trace Metal Values of the Soil Samples

Sam-ple	**Location**	**Analysis (ppm)**								
		pH	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Iron**	**Lead**	**Mercury**	**Zinc**
8SL	Bigacon	6.3	3.8	<0.005	284	2,332	6.7	<0.02	<0.0005	52
9SL	Purok 7, Bagacay	6.4	1.2	<0.005	188	196	4	19.8	0.03	64
10SL	Bagacay	6.6	0.9	<0.005	172	133	3.3	37.4	0.05	55.3

[14] CCC (2018). Toledo Copper Mine Tailings Storage Facility-ECC Amendment (Biga Tailings Storage Facility Enhancement and Marcona WRD Development)

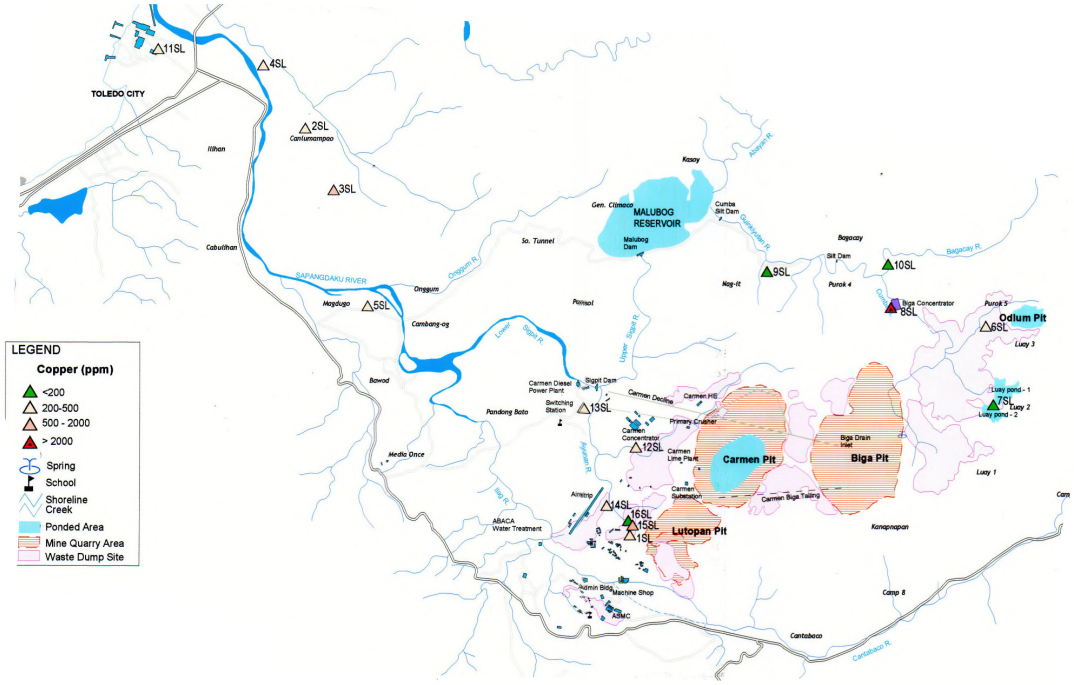


Fig. 2.21 Soil Sampling Stations
Source: Atlas Baseline Study

Table 2.11 Soil Sampling Results (2011)

Sample No	Date	pH	OM	P (ppm)	K (ppm)
L-T1	5-Jan-11	6.2	3	10	def
L-T2	5-Jan-11	6.1	3	100+	def
L-T3	5-Jan-11	6.2	3	100+	def
L-T4	5-Jan-11	6	2	50	def
L-T5	5-Jan-11	6.2	2	18	def
L-T6	5-Jan-11	5.3	3	100+	def
L-T7	5-Jan-11	5.8	3.5	100+	def
L-T8	5-Jan-11	6	3.5	88	def
TG - T1	5-Jan-11	5.2	3.5	100+	def
TG - T2	5-Jan-11	5.6	3.5	100+	def
TG - T3	5-Jan-11	6.6	3	100+	def
TG - T4	5-Jan-11	6.3	3.5	100+	def
TG - T5	5-Jan-11	5.4	2.5	84	def
TG - T6	5-Jan-11	6.8	3	97	def
TG - T7	5-Jan-11	5	3	100+	suf
TG - T8	5-Jan-11	6.7	3	100+	def
AM - T1	5-Jan-11	5	3	100+	suf
AM - T2	5-Jan-11	5.5	3	100+	def
AM - T3	5-Jan-11	6.6	3	100+	suf
AM - T4	5-Jan-11	6.6	3.5	100+	def

AM - T5	5-Jan-11	6.6	3	100+	suf
AM - T6	5-Jan-11	6.6	3.5	100+	suf
MT – 1	5-Jan-11	5	3.5	100+	def
MT – 2	5-Jan-11	4.1	3	100+	def
MT – 3	5-Jan-11	6.4	3.5	100+	def
MT – 4	5-Jan-11	6.5	3	100+	def
MT – 5	5-Jan-11	6	3	100+	def
MT – 6	5-Jan-11	5.4	2	56	suf
MT – 7	5-Jan-11	4.5	2	31	def
MT – 8	5-Jan-11	5.3	3	100+	def
V - T1	5-Jan-11	4.9	3	100+	def
V - T2	5-Jan-11	4.9	3	100+	def
V - T3	5-Jan-11	6.6	3.5	100+	suf
V - T4	5-Jan-11	6.5	3.5	100+	suf
V - T5	5-Jan-11	5.8	3	100+	def
V - T6	5-Jan-11	6.4	2.5	100+	def
V - T7	5-Jan-11	6.2	1.5	28	suf
V - T8	5-Jan-11	6.2	1.5	23	def
Vermicast		7.07	0.42	0.31	0.56

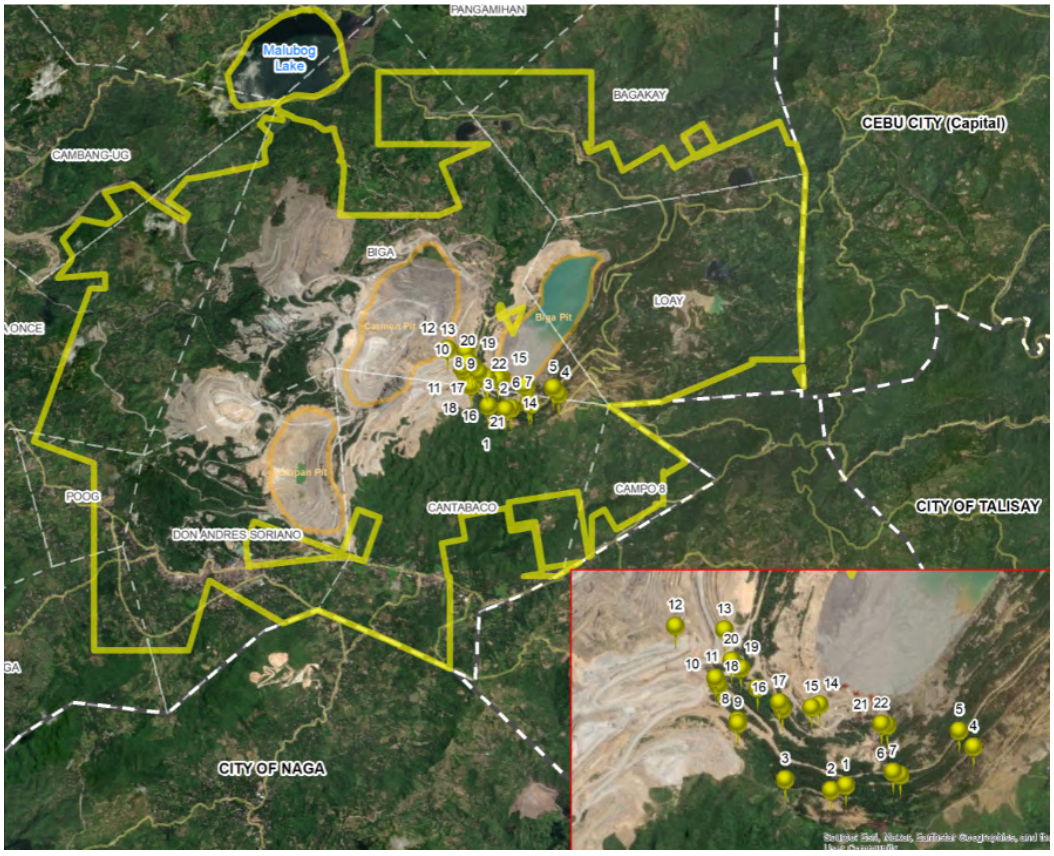


Figure 2.22 Soil Sampling Map

The Atlas Baseline Study, discusses the results of the soil sampling, as follows:

> *"Most of the soils are acidic, based on the threshold of 7. Two soils, one from Carmen power plant site and the black soil (coal ash) that covers the sulfide rich mine waste indicated alkaline soils and relatively low metal concentrations. The limestone rockmass that underlies the Carmen power plant has likely controlled the acidity of the soil. The black soil is relatively free of sulfides.*
>
> *Based on the intervention value C of the Netherlands guidelines, three soils have exceeded the standard for Cu. The rest of the soils have not exceeded the standard for the metals that has been analyzed.*
>
> *Based on the Target Value, Cu and Pb have been exceeded in 15 and one soil sample, respectively. Only the black and alkaline soil (16SL) that has been placed on top of the mine wastes near kyber pass is below the standard.*
>
> *The soils from Kyber Pass (15SL), Bigacon (8SL) and Anislag (3SL) exceeded the intervention value for Cu. These soils indicated the first three highest metal concentrations as well. The soils from Kyber Pass and Bigacon are mine wastes that appear to be rich in sulfides. The soil from Canlumpao was obtained at the Sapangdaku floodplan which is underlain by oxidized, yellowish brown, siliceous sand that has been indicated by the local residents as mine tailings that has spilled, transported and deposited by floodwaters following a typhoon sometime in the 1970s.*
>
> *The oil contaminated soil from the repair shop at Kyber Pass which indicated the highest Cu content has an alkaline pH (theoretically because of the hydrocarbons).*
>
> *The most dominant metal in the soils are Cu followed by Cr then Zn. .. The arsenic values of the soil vary from 0.60ppm to 4.3ppm averages 2.1ppm. The US EPA regulates arsenic as a carcinogen and has developed a variety of toxicity values for use in setting remedial objectives for arsenic. While the US EPA has not established a national regulation regarding arsenic in soil, its generic soil screening level (SSL) for arsenic in soil is 0.40 mg/kg corresponding to a cancer risk level of one-in-one-million for exposure through soil ingestion… All soils exceed the SSL of the US EPA.*

Loss of Soil Fertility[15]. At the primary impact area-Biga Pit and immediate surroundings, overflow pipeline and support infrastructure, the loss of soil fertility will be immediate as the ground will be directly disturbed and affected by construction and operation activities.

In the case of the secondary impact area, loss of soil fertility, will be attributed to "… [t]he run-off water directly going to nearby fields or passing through them changes the salt content of soil and subsoil layers thereby reducing the fertility of the land, this manifests itself in the form of loss of yield of crop… [a]part from this nearby settlements are always affected by the degraded environment in terms of water and air pollution, which also affect the health as well as their production from the fields… [b]eyond the potential for pollutant impacts on human and aquatic life, there are potential physical impacts associated with the increased runoff velocities and volumes from new land disturbance activities; increased velocities and volumes can lead to downstream flooding, scouring of stream channels, and structural damage to bridge footings and culvert entries (Singh, 2007)".

In the case of the secondary impact area (downstream of the outfall of the relief-overflow pipeline), loss of soil fertility, will be attributed to excessive volume of overflow water flooding nearby fields or in extreme cases accidental tailings spill. While the probability of these events are low and unlikely to

[15] CCC (2018). Toledo Copper Mine Tailings Storage Facility-ECC Amendment (Biga Tailings Storage Facility Enhancement and Marcona WRD Development)

occur, the loss of agriculture/economic amenities (production incomes), property and possibly lives shall be adequately compensated.

2.1.4 Terrestial Ecology

2.1.4.1 Vegetation Removal and Loss of Habitat

Given that the Toledo Copper Mines has already been existing and operational for a long time, most of the areas where mining operations are conducted are heavily disturbed area and cleared of vegetation, which includes the open mine pits (Carmen and Lutopan), Biga Pit TSF, Waste Rock Dumps (currently utilized), crusher/processing areas, and areas where support facilities and amenities are located.

Proposed activities/development that will be undertaken within the TCM that will have an impact on existing undisturbed vegetation are the following:

1. Proposed modifications of the Airstrip Waste Rock Dump – cancellation of the Ilag area, but to be expanded on the other side, and the introduction of waste rock processing facility for utilization as construction materials
2. Proposed Biga TSF Enhancement and Development of the Marcona WRD. The Marcona occupies a land area of 69.08 hectares with a capacity of 92M tonnes. Rock waste dump with an elevation of 540 meters having a top area of 41.177 hectares, and a bottom area of 6.0168 hectares. The proposed Marcona Waste Rock Dumpsite is designed to accommodate the waste striped/mine from the Carmen Pit.

Flora and Fauna Airstrip-Lutopan Pit Area

The CG-ABS study (2008) conducted a flora and fauna inventory in a number of sampling stations (transects) around the mine site, one of which is located along the airstrip-lutopan pit area, which the study described as follows: "The station is a reforested site and the vegetation is homogenous being dominated by Acacia Auricauliformes… [s]ince the whole stretch from the air strip to Lutopan pit is reforested and very steep, only one transect was laid and only five quadrats were established…"

Table 2.12 **Terrestial Flora and Fauna, CG-ABS Study (2008)**

	Common Name	Species Name (Family)	Value
	Flora		
1	Awri	Acacia auricauliformis	Introduced, reforestation species
2	Tree fern	Angiopteris evecta (Marratiaceae)	Indicator of moisture and acidic soil
3	Hagonoy	Chromolaena odorata (Asteraceae)	Weed, allelopathic, medicinal
4	Balog-balog	Clitorea ternatea (Fabaceae)	Weed
5	Apale	Dioscorea esculenta (Dioscoreaceae)	Food Source
6	Oak-leaf fern	Drynaria quercifolia	Epiphytic
7	Lagnob	Ficus septic (Moraceae)	Medicinal
8	Balete	Ficus benjamina (Moraceae)	Habitat for many birds and insects
9	Kanding-kanding	Lantana camara (verbenaceae)	Weed
10	Bongabong	Macaranga grandifolia (Euphorbiaceae)	Timber
11	Yagomyum	Melastoma malabathricum (melastomataceae)	Weed
12	Bagalunga	Melia dubia (meliaceae)	Timber
13	Climbing hemp weed	Mikania cordata (Asteraceae)	Weed
14	Nephrolepis	Nephrolepis biserrata ((polypdiaceae)	Indicator of acidic soil
15	Langi-langi	Phyllanthus reticulatos	Weed; bird's food source
16	Carabao grass	Paspalum conjugatum (poaceae)	Weed
17	Talahib	Saccharum spontaneum (Araliaceae)	Weed
18	Galamay-amo	Schefflera odorata (araliaceae)	Ornamental
19	Limbagat	Stachytarpheta jamaicensis (Verbenaceae)	Weed

	FAUNA		
1	Ants	Polyergus sp. (hymeoptera)	Scavenger
2	Aphids	Aphis sp. (homoptera)	Garden pest
3	Bees	Xylocopa sp. (hymeoptera)	Pollinator
4	Sayao-sayao/Pygmy swiftlet	Colocalia troglodytes	Insectivore
5	Butterflies	(Diptera)	Pollinator
6	Caterpillar	(Diptera)	Leaf browser
7	Dipteran flies	(Diptera)	Scavenger
8	Mosquitoes	(Diptera)	Blood-sucker
9	Spiders	(Aranea)	Insectivore
10	Anay/subterranean termites	Amitermis sp. (isopteran)	Detritivore

Figure 2.23 Existing Airstrip Site WRD & Proposed Expansion Area

Biga TSF and Marcona WRD[16]

Existing vegetation of the site is composed of grass, shrubs, and pioneer tree species which include bamboo species, cogon (*Imperata cylindrica*), hauili (*Ficus septica*), tibig (*Ficus nota*), binunga (*Maracanga tanarius*), anabiong (*Trema orientalis*), malapapaya (*Polyscias nodosa*), Ipil-ipil (*Leucaena leucocephala*) and hagonoy. A thirty-old plus mahogany (*Sweitenia spp.*) tree plantation can be found near Sitio Pandong Bato, Brgy. Media Onse.

Flora and Fauna in Project-affected Areas. The CG-ABS study (2008) conducted a flora and fauna inventory in a number of sampling stations (transects) around the mine site that includes affected areas of the Toledo Copper Mines TSF such as: Camen-Biga Pits and Sigpit River Station.

[16] CCC (2018). Toledo Copper Mine Tailings Storage Facility (Biga TSF Enhancement and Marcona WRD Deelopment) EPRMP-Final Report

The CG-ABS Study noted that the "*Carmen-Biga Pits Area are the two major mining pits inside the CCC/Toledo Copper Mine. Rehabilitation of these pits is on-going. The areas surrounding them are characterized by patches of secondary forest, reforested areas, and a pastureland. In this station, due to spatial heterogeneity, two transects were laid and 20 quadrats were established*."

A most recent 'Biodiversity Assessment Study (DENR-ERDB,___)" was conducted on the stations originally assessed by GeoKonsult (2008).

The DENR-ERDB study was undertaken in two phases/studies (1st and 2nd study). Field activities for the **first study** was already completed. Initial results shows that a total of 15 individual species of forest trees composed the adult vegetation of the five (5) sampling sites within the mining area. It was a combination of indigenous and exotic forest trees composed of pioneer and fast growing species which are the most adaptive, resistant and prolific during succession. A total of 64 individual species of plants were also observed on the understory. For the avifauna, a total of 25 species of birds were observed on the mining site. Family Columbidae has the most number of species. Dove species observed were White-eared Brown Pigeon (Phapitreron leucotis), Spotted Dove (Spilopelia chinensis), and Zebra Dove (Geopelia striata). *See Annex for copy of the results of the 1st study*

Table 2.13 List of **Flora and Fauna in Carmen-Biga Pit Area, Geokonsult-ABS Study (2008)**

	Common Name	Species Name (Family)	Value
	FLORA		
1	**Okra**	Abelmoschus esculentus (malvaceae)	Vegetable
2	**Biga**	Alocasia machrorhiza (Araceae)	Food Source
3	**Gadyapa**	Amarahthus spinosus	Weed, medicinal
4	**Hilbas**	Artemisia Vulgaris (Asteraceae)	Weed, medicinal
5	**Toway-toway**	Bidens pilosa (Asteraceae)	Weed
6	**Bagon-bagon**	Borreria ocymoides (Rubiaceae)	Weed
7	**Marakawayan**	Brachiaria reptans (Poaceae)	Weed
8	**Bermuda**	Cynodon dactylon (Poaceae)	Landscape plant
9	**Abobo**	Cissampelos pareira (Fabaceae)	Weed
10	**Kapal-Kapal**	Calotropis gigantean (Asclepediaceae)	Weed, medicinal
11	**Hagonoy**	Chromolaena odorata (Asteraceae)	Weed, medicinal
12	**Amorseco**	(Chrysopogon aciculatus (Poaceae)	Weed
13	**Kalog-kalog**	Crotalaria retusa (Fabaceae)	Weed
14	**Kalabasa**	Cucurbita maima (Cucurtaceae)	Food Source
15	**Sedge**	Cuperus sp. (Cyperaceae)	Weed
16	**Busikad**	Cyerus kyllingia (Cyperaceae)	Weed, medicinal
17	**Damong Balang**	Datcylochtenium aegyptinum (Poaceae)	Weed
18	**Kilob**	Dicranopteris linearis (Gleicheniaceae)	Weed
19	**Banban**	Donax Cannaeformis (Rarantaceae)	Weed
20	**Dila-dila sa iro**	Elephantopus scaber (Asteraceae)	Weed
21	**Bila-bila**	Eleusine indica (Poaceae)	Weed
22	**Setim**	Emilia sonchifolia (Asteraceae)	Weed
23	**Lagnob**	Ficus septic (Moraceae)	Medicinal
24	**Cogon**	Imperata Cylindrica (Poaceae)	Weed, housing construction matl
25	**Tagum**	Indifogefera Suffruticosa (Fabaceae)	Weed
26	**Kanding-Kanding**	Lantana camara (verbenaceae)	Weed
27	**Ipil-ipil**	Leucaena leucocephala (Fabaceae)	Firewood, mosquito repellent
28	**Nitong Hapon**	Lygodim japnicum (Schizaeceae)	Weed
29	**Binunga**	Macaranga tanarius (Euphorbiaceae)	Wood/timber
30	**Alkoba**	Malvastrum coromandilianum (Malvaceae)	Weed
31	**Yagomyum**	Melastoma malabathricum	weed
32	**Climbing hemp**	Mikania cordata (Asteraceae)	Weed
33	**Kipi-kipi**	Mimosa pudica (Fabaceae)	Weed
34	**Gangan**	Moghaia strobilifera	Weed
35	**Saging**	Musa sp. (Musaeae)	Food source
36	**Bold Sword Fern**	Neprholepis cordifolia	Weed
37	**Carabao Grass**	Paspalum conjugatum (poaceae)	Weed
38	**Bayabas**	Psidium guajava (Myrtaceae)	Food source; medicinal
39	**Tangan-tangan**	Ricinus communis (Euphobiaceae)	Medicinal
40	**Elepante**	Stachytapheta jamaicensis (Verbenaceae)	
41	**Talahib**	Saccharum spontaneum (Araliaceae)	Weed

42	**Red Ginger**	Cucuma sp. (Zingiberaceae)	Ornamental
43	**Sellaginella**	Sellaginella sp. (Selaginellaceae)	Ornamental
44	**Malatalong**	Solanum verbacifolium (Solanacea)	Weed
45	**Batuan**	Wrightia calycina (apocynaceae)	Timber
	FAUNA		
1	**Alindahao/Dragonflies**	Acisoma panorpoides	Predator, insectivore
2	**Apan/Grasshopper**	Melecoides sp. (orthoptera)	Herbivore
3	**Apan-apan/Grasshopper**	Chlolealtes sp (orthptera)	Herbivore
4	**Aphids**	Aphis sp. (homoptera)	Garden pest
5	**Bakukang/Beetles**	Geotrupes sp. (coleopteran)	Pollinator
6	Buyog/Bees	Xylocopa sp. (hymeoptera)	Pollinator
7	**Cicada**	Stenocranus sp (homoptera)	
8	**Hulmigas/Red Ants**	Formica sp (Hymeoptera)	Scavenger
9	**Kabakaba/Butterflies (yellow)**	Eurema sp (Lepidoptera)	Pollinators
	White	Pieres sp. (Lepidoptera)	
10	**Kaka/argiope spiders**	Argiope sp. (Aranea)	Insectivore
11	**Lagong/blowfly**	Calliphora sp. (Diptera)	Scavenger
12	Lamok/Mosquitoes	(Diptera)	Blood-sucker
13	**Langaw/housefly**	Musca sp (Diptera)	Scavenger
14	**Moths**	(Lepidoptera)	Pollinator
15	**Sulom/black ants**	Polyergus sp (hymeoptera)	Scavenger
16	**Kokok/phil. coucal**	Centropus viridis viridis (cuculiformes)	Endemic, insectivore
74	**Langi-langi**	Securenega virusa (Euphorbiaceae)	Weed
75	**Daua**	Setaria genculata (Poaeceae)	Weed
76	**Talong**	Solanum melongena (Solanaceae)	Food Source
77	**Talong-talong**	Solanum nigrum (Solanaceae)	Weed
78	**Limbagat**	Stachytarpheta jamaicensis (Verbenaceae)	Weed
79	**Mahogany**	Swietenia macrophylla (Meliaceae)	Timber
80	**Lomboy**	Syzygium cumini (Myrtaceae)	Food source
81	**Cacao**	Theobroma cacao (Byttneriaceae)	Food source
82	**Victory**	Tridax procumbens (Asteraceae)	Weed
83	**Vernonia**	Vernonia cinerea (Asteraceae)	Weed, ornamental
84	**Hagonoy**	Wedelia trilobata (Asteracea)	Weed
85	**Siyapo**	Wikstroemia lanceolata (Thymelaeaceae)	Timber
86	**Wild cherries**	Zizyphus jujuva (Rhamnaceae)	Food source
	FAUNA		
1	Ants	Polyergus sp. (hymeoptera)	Scavenger
2	Aphids	Aphis sp. (homoptera)	Garden pest
3	Buyog/Bees	Xylocopa sp. (hymeoptera)	Pollinator
4	Butterflies	Papilio sp (Lepidoptera)	Pollinator
5	Caterpillar	(Lepidoptera)	Browser
6	**Crab Spiders**	Mesumena sp (Aranea)	Insectivore
7	**Dipteran flies**	Diptera	scavenger
8	**Alindahao/Dragonflies**	Acisoma panorpoides	Predator, insectivore
9	**Apan/Grasshopper**	Melecoides sp. (orthoptera)	Herbivore
10	**Houseflies**	Musca sp (Diptera)	Scavenger
11	**Lukso-lukso/leaf hoppers**	Homoptera	Grazer
12	Lamok/Mosquitoes	(Diptera)	Blood-sucker
13	**Sayao-sayao/pygmy swiftlet**	Colocalia troglodytes	Insectivore
14	**Squash bug**	Acantocephala sp. (Hemiptera0	Pollinator
15	**Toad**	Bufo marinus (Anura)	Insectivore

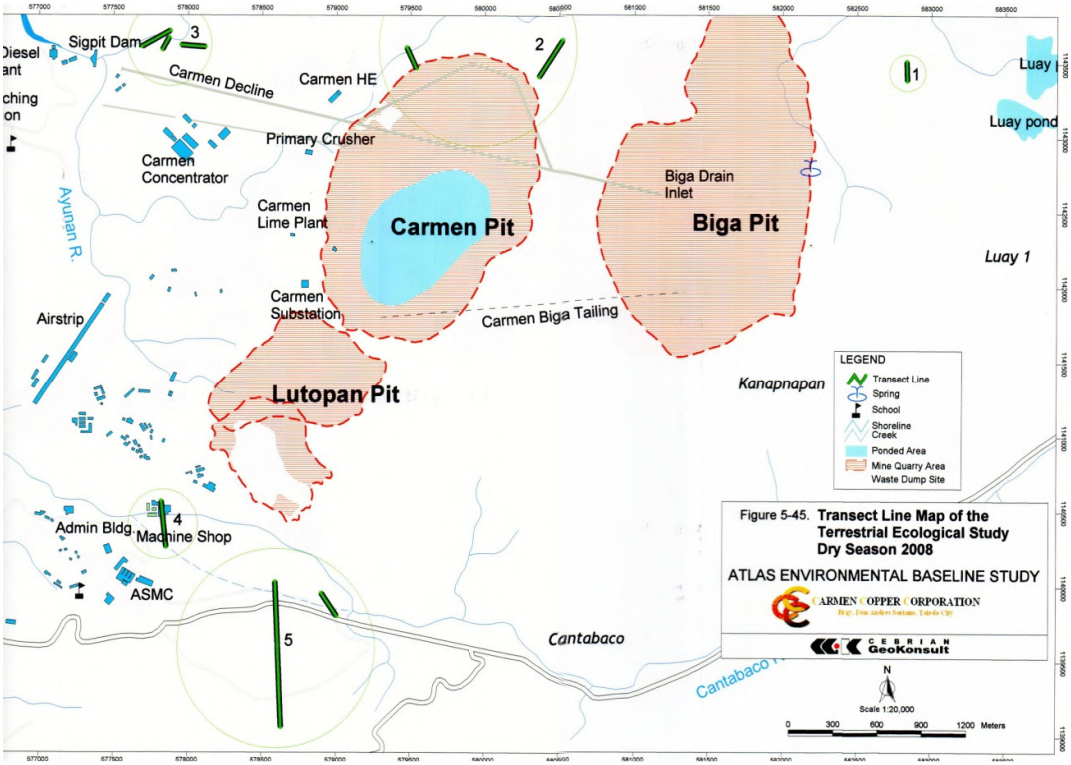


Fig.2.24 Transect Line Map of the Terrestial Ecological Study

Most recent tree inventory conducted April-May 2018 within the Marcona WRD project site, revealed the following:

Table 2.14 Inventory of economically Valuable Trees Inside the Proposed Marcona Waste Dump

No	Species	Category	No of trees	Ave Dia. (cm.)	Ave. M. Ht. (m.)	Log Vol. (cu.m.)	Bd. Ft.
1	Anabiong	Native	112	16.88	3.40	1.14	484.46
2	Avocado	Exotic	1	30.00	5.00	0.04	15.49
3	Bagalunga	Native	17	22.35	5.12	0.51	216.77
4	Binunga	Native	37	15.81	3.27	0.33	141.90
5	Coconut	Exotic	47	31.55	6.91	3.60	1,527.05
6	Gmelina	Exotic	198	34.41	4.67	8.23	3,488.50
7	Guyabano	Exotic	16	17.69	2.63	0.09	40.21
8	Ipil-ipil	Exotic	2	30.00	2.00	0.01	4.96
9	Kamansi	Native	1	30.00	10.00	0.15	61.96
10	Lomboy	Native	8	28.13	3.13	0.12	49.67
11	Mahogany	Exotic	518	57.90	6.34	76.51	32,424.67
12	Mango	Exotic	56	50.14	2.71	1.56	660.23
13	Molave	Native	9	31.89	3.00	0.13	56.57
14	Nangka	Exotic	18	24.61	3.44	0.31	131.32
15	Narra	Native	3	50.00	4.33	0.15	64.24
16	Robles	Native	41	17.32	2.49	0.23	98.73
17	Teak	Native	39	40.74	2.49	0.61	257.79
	Total		1,123			93.74	39,724.55

Table 2.15 Inventory of trees that will be affected by the Amended Biga Tailings Storage Facility

Species	Average		Timber Land		A&D		Total	
	Dia (cm.)	Ht. (m.)	No of Trees	Volume	No of Trees	Volume	No of Trees	Volume
Auri	12.40	3.90	9,529	372.72	2,095.00	80.37	11,624.00	453.09
Mangium	12.79	3.93	18,207	761.88	7,605.00	315.85	25,812.00	1,077.74
Robles	8.50	4.00	2	0.04	-	-	2.00	0.04
Crassicarpa	12.45	3.90	9,560	376.93	1,969.00	76.99	11,529.00	453.92
Total	12.62	3.91	37,298	1,511.57	11,669.00	473.21	48,967.00	1,984.78

Rehabilitation Site of Biga Pit[17]

The rapid biodiversity survey was conducted prior to the planting of cloned indigenous climax trees in the experimental plots of the study titled, "*Performance of Different Cloned Climax Species Inter-planted in Existing Tree Plantation Species within Mined-out Areas*." The survey plots and transect were established inside the rehabilitation area of Carmen Copper Corporation along the southeast side of Biga Pit in Toledo City, Cebu, within the experimental plots. The following were assessed — Overstorey, understorey and regeneration species for flora; and avifauna, soil arthropods and nocturnal arthropods for fauna.

The activity aimed to determine the flora and fauna diversity status inside and along the study site (experimental plots) prior to the planting of the cloned indigenous climax species. Specifically, the activity aimed to: calculate the diversity indices using Shannon-Weiner DiversityIndex; determine the species richness and abundance; calculate the importance value for floral species; identify the observed flora and fauna species to the lowest possible taxa; and gather data for the soil profile of the experimental area.

Location of the Study. The survey was conducted within the rehabilitation area of Carmen Copper Corporation along the southeast side of Biga Pit. A two-kilometer avifauna transect-walk was established along the southern part of Biga Pit, with first point from 51 P 580856.00 E 1141791.00 N into 51 P 582473.00 E 1142312.00 N.

[17] Mining and Degraded Areas Rehabilitation Research Center (2018). Activity Report: Rapid Biodiversity Assessment in the Rehabilitation Site of Biga Pit, Carmen Copper Corp. DENR-ERDB

Figure 1. Imagery of the experimental sites from Google Earth: Yellow line = avifauna transect-walk, green plot = block 1, red plot = block 2, and blue plot = block 3

Figure 2. Experimental blocks showing the sampling points for soil arthropods

Figure2.25 Sampling Sites (Fig. 1 & 2)

The three 1m x 1m sampling plots for soil arthropods were established inside each three experimental blocks. A Light trap was also conducted in the location between the three experimental blocks. Light trapping was conducted from 6:00 PM until 8:00 PM. The table on the next page shows the elevation range of each block. The upper block (green outline) has an elevation range of 473 to 482 meters above sea level (masl), middle block (red outline has an elevation range of 461 to 471 (masl), and the lower block (blue outline) has an elevation range of 455 to 466 (masl). The upper and middle blocks had closely similar characteristics. They are both covered with overstorey canopy of Acacia auriculiformis A.Cunn. ex Benth. and Acacia mangium Willd. The understorey is vegetated with shrubs, such as Melastoma malabathricum L., and ferns. The lower block is also vegetated with A. auriculiformis and A. mangium. However, it had lesser vegetation of understorey species. Its ground had more leaf litter cover compared to the upper blocks. The understorey was also more exposed to the sun, compared to the upper blocks.

Results and Discussions

Avifauna. Eighteen species of avifauna were observed during the two-day two-km transect-walk survey. Avifauna species were categorized into 14 families from six taxonomic orders. Shown in the next table are the avifauna fauna observed during sampling.

Table 2 16 Avifaunal species composition

Order	Family	Species Name	Common Name
Accipitriformes	Accipitridae	*Haliastur indus* (Boddaert, 1783)	Brahminy Kite
Apodiformes	Apodidae	*Collocalia esculenta* (Linnaeus, 1758)	Glossy Swiftlet
Columbiformes	Columbidae	*Chalcophaps indica* (Linnaeus, 1758)	Common Emerald Dove

		Geopelia striata (Linnaeus, 1766)	Zebra Dove
		Streptopelia tranquebarica (Hermann, 1804)	Red Turtle-Dove
		Treron vernans (Linnaeus, 1771)	Pink-necked Green Pigeon
Coraciiformes	Alcedinidae	*Todiramphus chloris* (Boddaert, 1783)	White-collared Kingfisher
Cuculiformes	Cuculidae	*Centropus viridis* (Scopoli, 1786)	Philippine Coucal
Passeriformes	Acanthizidae	*Gerygone sulphurea* Wallace, 1864	Golden-bellied Gerygone
	Campephagidae	*Lalage nigra* (Forster, 1781)	Pied Triller
	Dicaeidae	*Dicaeum trigonostigma* (Scopoli, 1786)	Orange-bellied Flowerpecker
		Dicaeum australe (Hermann, 1783)	Red-keeled Flowerpecker
	Estrildidae	*Lonchura punctulata* (Linnaeus, 1758)	Scaly-breasted Munia
	Muscicapidae	*Saxicola caprata* (Linnaeus, 1766)	Pied Bushchat
	Nectariniidae	*Cinnyris jugularis* (Linnaeus, 1766)	Olive-backed Sunbird
	Oriolidae	*Oriolus chinensis* Linnaeus, 1766	Black-naped Oriole
	Rhipiduridae	*Rhipidura nigritorquis* (Vigors, 1831)	Philippine Pied Fantail
	Zosteropidae	*Zosterops montanus* Bonaparte, 1850	Mountain White-eye

The documented avian species were composed of six taxonomic orders, with Passeriformes as the largest with 10 recorded species. The other observed orders were Accipitriformes, an order that includes most of the diurnal birds of prey (eg. hawks, eagles, vultures, and many others) (Christidis & Boles 2008); Apodiformes, an order which composed of swifts (Apodidae), treeswifts (Hemiprocnidae); Columbiformes, an order consisting of pigeons and doves; Coraciiformes, group of colorful birds with three forward-pointing toes (syndactyly), include kingfishers and bee-eaters (Johansson & Ericson, 2003); Cuculiformes, a medium-sized slender and ground-dwelling birds, and mostly live in trees and feed on insects, insect larvae and a variety of other animals as well as fruit (Anton et al., 2008); and Passeriformes, an order distinguished by the arrangement of their toes (three pointing forward and one back) which facilitates perching (Barker et al., 2002).

Table 2.17. Observed avifauna species from each transect-walk segment

Segment	Common Name	Day 1	Day 2	Segment	Common Name	Day 1	Day 2
1	Glossy Swiftlet	2	3	6	Glossy Swiftlet	2	2
	Common Emerald Dove	2	4		Scaly-breasted Munia	3	-
	Mountain White-eye	3	4		Pink-necked Green Pigeon	1	-
	White-collared Kingfisher	-	2		Golden-bellied Gerygone	-	4
	Zebra Dove	-	2	7	White-collared Kingfisher	2	-
2	White-collared Kingfisher	1	1		Glossy Swiftlet	12	6
	Mountain White-eye	7	3		Zebra Dove	2	1
	Glossy Swiftlet	5	4		Mountain White-eye	3	2
	Pied Triller	1	-		Pied Bushchat	1	1
	Zebra Dove	1	-		Orange-bellied Flowerpecker	1	-
	Common Emerald Dove	2	2		Red Turtle-Dove	-	1
	Orange-bellied Flowerpecker	-	2		Pied Triller	-	2
3	White-collared Kingfisher	3	3	8	Zebra Dove	2	-
	Zebra Dove	2	1		Glossy Swiftlet	6	7
	Common Emerald Dove	1	3		Pink-necked Green Pigeon	2	-
	Glossy Swiftlet	5	4		Olive-backed Sunbird	3	-
	Orange-bellied Flowerpecker	2	2		Mountain White-eye	2	-

	Red-keeled Flowerpecker	1	-		Pied Triller	-	2
	Olive-backed Sunbird	2	-		Red-keeled Flowerpecker	-	2
	Pied Triller	-	2		Philippine Pied Fantail	-	1
	Mountain White-eye	-	8		White-collared Kingfisher	-	1
4	Glossy Swiftlet		3	9	Scaly-breasted Munia	3	-
	White-collared Kingfisher	1	1		Glossy Swiftlet	2	5
	Golden-bellied Gerygone	3	-		Golden-bellied Gerygone	2	4
	Mountain White-eye	2	3		Pied Triller	1	-
	Red-keeled Flowerpecker	1	1		Mountain White-eye	3	5
	Zebra Dove	-	1		Philippine Coucal	1	-
	Common Emerald Dove	-	1		White-collared Kingfisher	-	1
	Philippine Pied Fantail	-	2	10	Zebra Dove	2	-
5	White-collared Kingfisher	3	1		Olive-backed Sunbird	1	-
	Red-keeled Flowerpecker	2	-		White-collared Kingfisher	1	2
	Common Emerald Dove	2	-		Common Emerald Dove	1	-
	Mountain White-eye	6	2		Glossy Swiftlet	2	3
	Brahminy Kite	-	2		Philippine Coucal	1	1
	Olive-backed Sunbird	-	2		Mountain White-eye	2	6
6	Glossy Swiftlet	8	4		Golden-bellied Gerygone	3	-
	Zebra Dove	1	1		Black-naped Oriole	1	-
	Mountain White-eye	2	5		**TOTAL**	**149**	**138**

Shown in Table 2.18 is the list of avian species observed in each transect-walk segment, which has a length of 200 m, and the number of individuals. Segments three, eight and ten have the largest value for species richness of nine species. Meanwhile, the first segment, which is thekilometer zero to 200, has the least species richness value of six species. Despite of site homogeneity, in terms of vegetative cover, there is still variation in species richness across eachtransect-walk segment. However, the trend for species richness shows minimal variation.25 16

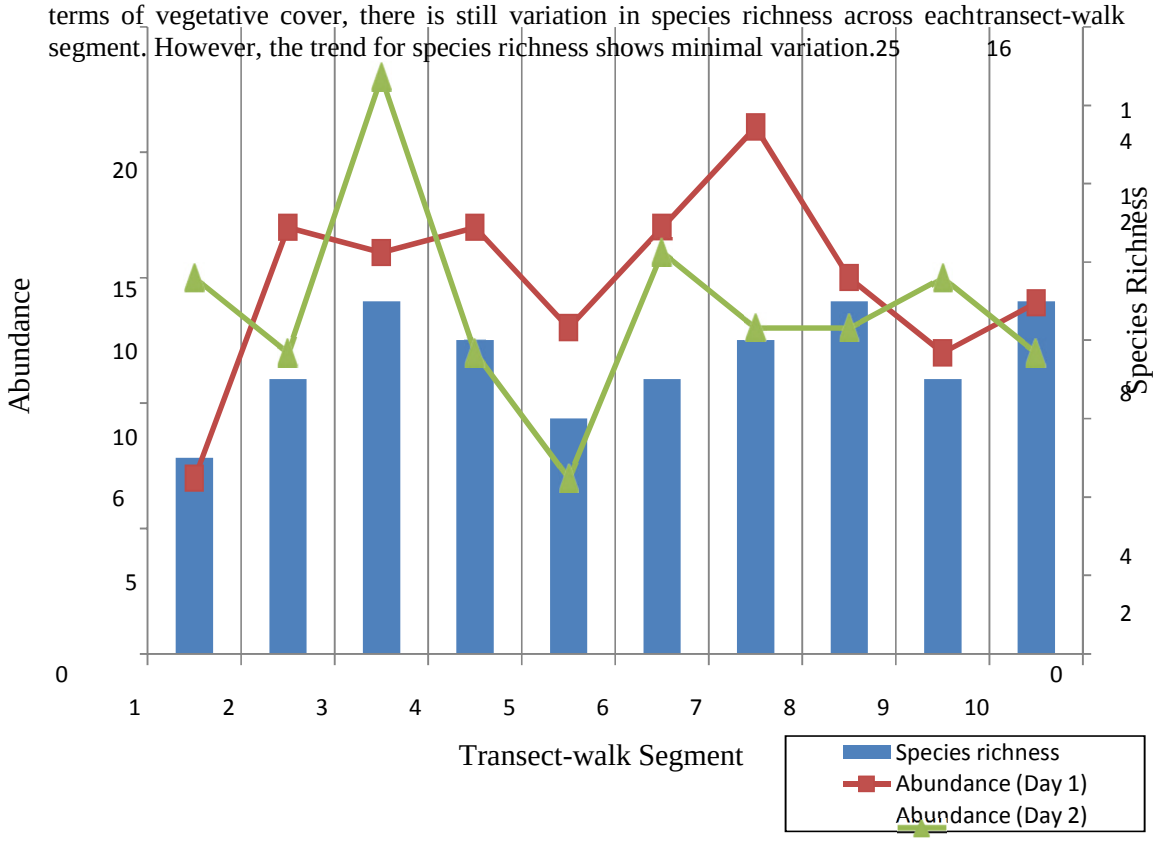


Figure 2.26 Species richness and abundance of each transect-walk segment

The mean diversity index for the two-day sampling for avian species were calculated. Shown in the table below were the values of the following calculated parameters — maximum diversity, Shannon-Weiner Diversity Index and Evenness or Equitability. There were 15 species recorded on both sampling periods. The first sampling recorded an abundance of 149, and 138 during the second sampling. The maximum diversity for each sampling period has a value of 2.708, which was relatively low. The computed diversity index for sampling periods are 2.098 and 2.055, for first and second day, respectively. The mean diversity index for both sampling period was 2.077. The evenness or equitability of the diversity index values were 0.775, and 0.759, for first and second day, respectively. Shown in Figure 4 is the abundance of each avian species.

Conservation status of all species observed were classified as belonging to least concern based on the International Union for Conservation of Nature (IUCN, 2013) Red List. Four species were endemic, or exclusively found in the Philippines — Red-keeled Flowerpecker, Olive-backed Sunbird, Philippine Pied Fantail, and the Philippine Coucal.

Abundance of each avian species is shown in Figure 2.28. Glossy swiftlet has the highest abundance among all species. Mountain White-eye has the second highest abundance.

Table 2.18 Avian species ecological indices and conservation status

Common Name	Species Name	Day 1	Day 2	Conservation Status $	Endemicity#
Glossy Swiftlet	Collocalia esculenta (Linnaeus, 1758)	53	41	Least Concern	Resident
Common Emerald Dove	Chalcophaps indica (Linnaeus, 1758)		10	Least Concern	Resident
Mountain White-eye	Zosterops montanus Bonaparte, 1850	30	38	Least Concern	Resident
White-collared Kingfisher	Todiramphus chloris (Boddaert, 1783)	11	12	Least Concern	Resident
Zebra Dove	Geopelia striata (Linnaeus, 1766)	10		Least Concern	Resident
Pied Triller	Lalage nigra (Forster, 1781)			Least Concern	Resident
Orange-bellied Flowerpecker	Dicaeum trigonostigma (Scopoli, 1786)			Least Concern	Resident
Red-keeled Flowerpecker	Dicaeum australe (Hermann, 1783)			Least Concern	Endemic
Olive-backed Sunbird	Cinnyris jugularis (Linnaeus, 1766)			Least Concern	Endemic
Golden-bellied Gerygone	Gerygone sulphurea Wallace, 1864			Least Concern	Resident $
Philippine Pied Fantail	Rhipidura nigritorquis (Vigors, 1831)			Least Concern	Endemic
Brahminy Kite	Haliastur indus (Boddaert, 1783)			Least Concern	Resident
Scaly-breasted Munia	Lonchura punctulata (Linnaeus, 1758)			Least Concern	Resident
Pink-necked Green Pigeon	Treron vernans (Linnaeus, 1771)			Least Concern	Resident
Pied Bushchat	Saxicola caprata (Linnaeus, 1766)			Least Concern	Resident
Red Turtle-Dove	Streptopelia tranquebarica (Hermann, 1804)			Least Concern	Resident
Philippine Coucal	Centropus viridis (Scopoli, 1786)			Least Concern	Endemic
Black-naped Oriole	Oriolus chinensis Linnaeus, 1766	1	-	Least Concern	Resident
	Abundance (N)	149	138		
	Species richness (S)	15	15		
	Diversity Index (H')	2.098	2.055		
	Maximum Diversity (H'max)	2.708	2.708		
	Evenness (E)	0.775	0.759		
	Average H'	2.077			

$ = data from IUCN Red List (2013); # = data from Kennedy et al., (2000)

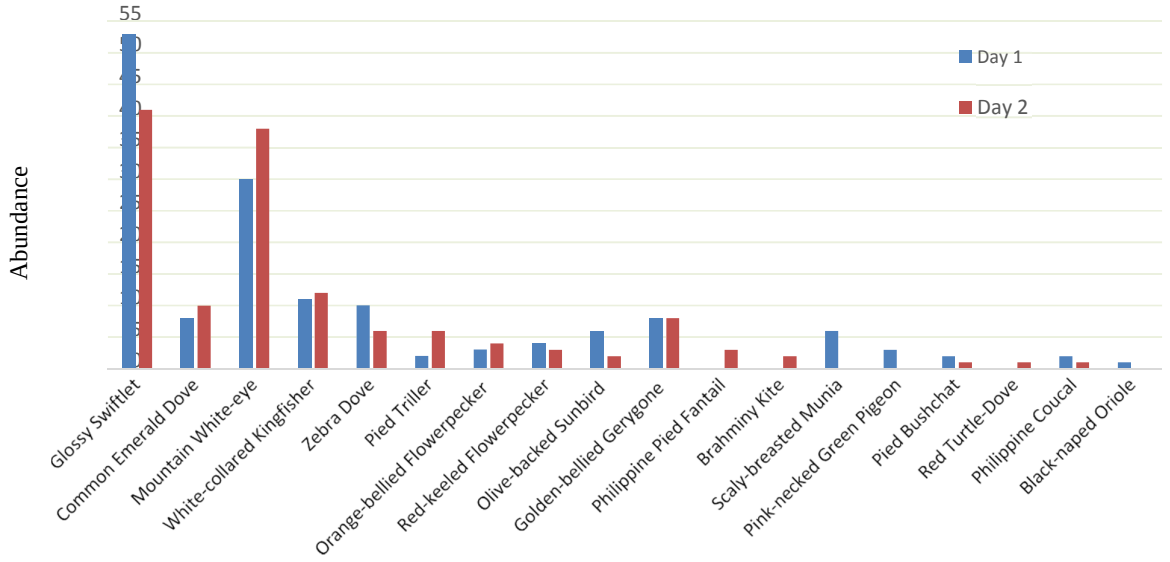


Figure 2.27. Abundance of avian species

Table 2.19 Feeding habit description of observed avian species

Common Name	Feeding Habit Description
Glossy Swiftlet	Catching insects in-flight
Common Emerald Dove	Graze for insects and fruits
Mountain White-eye	Omnivorous birds, depending on location rely on eithernectar from flowering trees or insects
White-collared Kingfisher	Very varied diet - small snails, insects (eg. Mantises andgrasshoppers)
Zebra Dove	Foraging on grounds and feeds on small grass and weedseeds, as well as insects and other small invertebrates
Pied Triller	Pied Trillers feed on various insects, which are taken on the ground, picked up from foliage, or are caught in mid-air
Orange-bellied Flowerpecker	Feeds on small fruits and nectar - recorded foods includefruits of *Eugenia*, *Dillenia suffruticosa*, *Melastoma malabathricum*,
Red-keeled Flowerpecker	Feeding includes fruit, nectar and pollen
Olive-backed Sunbird	Feeding includes fruit, nectar and pollen
Golden-bellied Gerygone	Often eats small fruits of various kinds and nectar
Philippine Pied Fantail	Insects. Very active; constantly on move when foraging; occasionally feeds near or on ground. Catches insects inair by flycatching
Brahminy Kite	Variety of small animals and carrion, including mammals,birds, reptiles, amphibians, fish, arthropods, crustaceans,shellfish, and more
Scaly-breasted Munia	Feeds on seeding grasses
Pink-necked Green Pigeon	Have diets of various fruit, nuts, and/or seeds
Pied Bushchat	Mainly insectivorous, and hunts from a prominent lowperch. Noted to feed on moths and whitefly.
Red Turtle-Dove	Feeds on seeds of grasses and herbs, as well as cultivatedseeds, including rice and maize, buds and young leaves
Philippine Coucal	Insects, including beetles and caterpillars. Usually feeds onor near the ground.
Black-naped Oriole	Feeds on berries and fruits.

Data from Bird Life International (2018), and Handbook of Birds of the World Alive (2018)

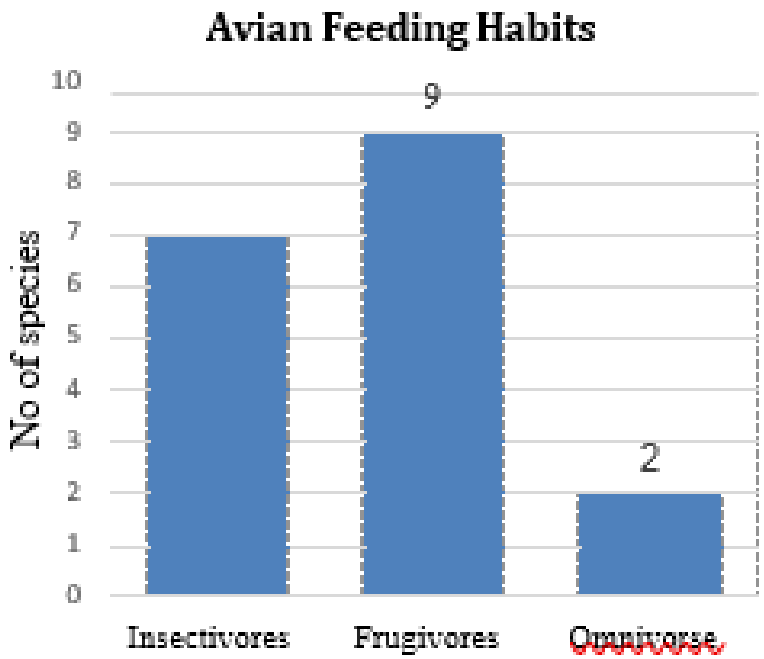


Figure 2.28. Avian species general feeding habit groups

Avian species observed in the sampling site were categorized based on their general feeding habit, which includes insectivores species that eats small to medium–sized arthropods; frugivores,species that feeds on fruits and nectars;and omnivores, species that are both frugivore and insectivore.

The sampling site has more frugivore species, nine species, compared to seven insectivore species. Most-likely,species in the site such as red-keeled flowerpecker and sunbirds mostly feed on fruits and nectar of *M. malabathricum*, *A. mangium*, and *A. auriculiformis*, which are dominant in the area. Notably, insectivore species in the area are the White-collared Kingfisher and Brahminy Kite, which are active inhunting preys such as small reptiles, and larger insects.

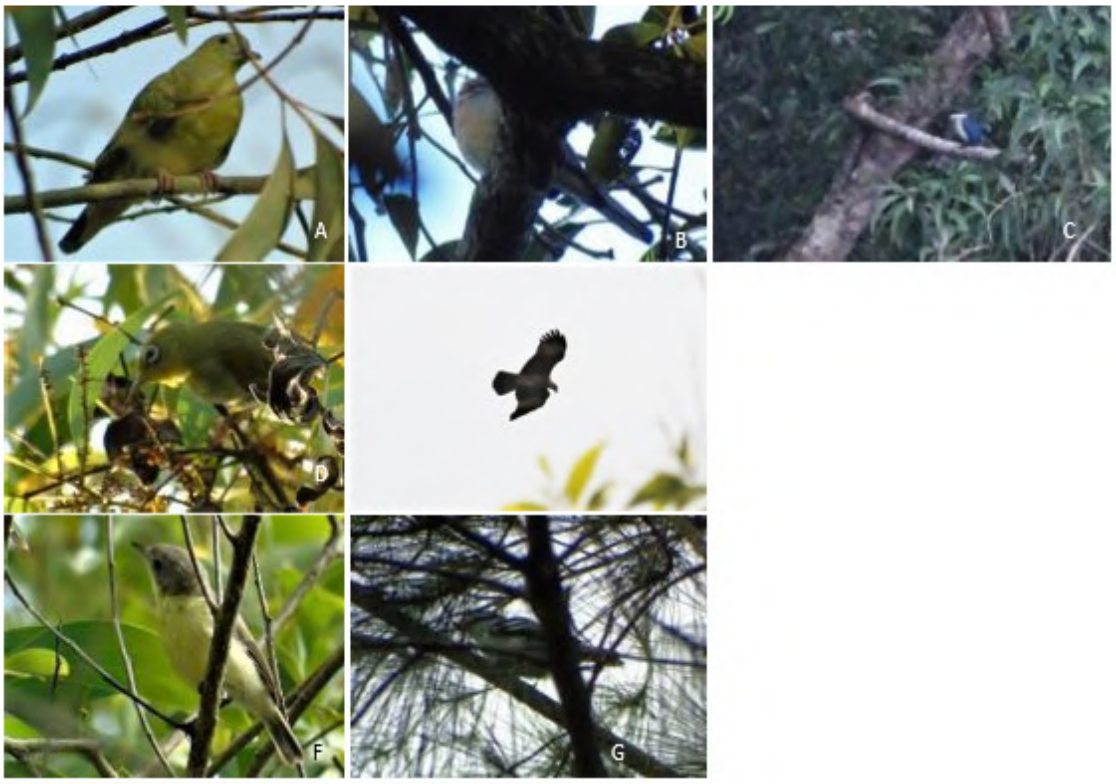


Figure 2.29 Avian Species photographed during transect-walk survey: (A) Pink-necked Green Pigeon; (B) Zebra Dove; (C) White-collared Kingfisher; (D) Mountain White-eye; (E) Brahminy Kite; (F)Golden-bellied Gerygone; and (G)

Avian, generally, have good system for seed dispersal over terrestrial ecosystems. Dispersal of seeds are easily facilitated through their wastes as they actively move around environment. Their feces also provide good fertilizer for the seeds they disperse, a good condition to germinate. Furthermore, several bird species may have been significant browsers of forest vegetation. Large proportion of forest tree and shrub species had fleshy fruits which are attractive to birds (McEwen, 1978). Birds also performed a significant role as pollinators in forests and that foliage of all kinds was eaten when fruit was least available (Godley, 1979). Because of extensive dietary overlap between different herbivorous birds and the turnover of both bird and plant species through evolutionary time, it is unlikely that plant species have evolved adaptations to browsing by particular birds, although evolutionary responses to bird browsing in general are possible (Ormerod & Watkinson, 2000).

In the rehabilitation site along Biga Pit in Carmen Copper Corporation, most bird species observed are mainly frugivores. They ideally help in the dispersal of seeds, which gives more chances of germination. Several insectivorous species are also found in the area, which mainly controls and browse for arthropod food sources inside vegetations. These insectivorous species are good indicator for presence of food source, particularly larger arthropods, reptiles and possibly small mammals. A raptor was also found in the area, which indicated that there is a possible food source within or around the rehabilitation site. Arthropods, particularly moths, are good food source for avian species, reptiles, and small mammals. They attract organisms or larger species to graze in the area.

Arthropod Survey: Soil arthropods. Soil arthropods were surveyed in each experimental block. Three sampling points were established for each three blocks. Each observed species is identified putatively according to their taxonomic family. They are further classified according to their function in the soil — soil borers, arthropods that largely burrows along soil detritivores or decomposers, which eat away any plant or animal remains they can find and carnivores, which contribute significantly to the invertebrate predatory biomass in terrestrial ecosystems.

Table 2.20. List of arthropods identified based on their taxonomic group/families

Common Name	Taxonomic name/group	Block 1	Block 2	Block 3
Burrowing cockroach	Ectobiidae	2		
	Blattidae	12		
Black banded yellow insect	-			
Earthworm	*Lumbricus* sp			
Millipedes	Diplopoda	5		17
Termite	Isoptera			2 (larvae)
Ants	Formicidae	colony	colony	colony
Centipedes	Chilopoda	3		
Arachnid	Araneomorphae	4		
White-banded Arachnid	Araneomorphae	2		

Figure 2.30. Soil borer arthropods: (A — B) *Lumbricus* spp.; (C) Diplopoda(Millipedes); (D) Blattidae; (E) Ectobiidae; (F) Isoptera (Termite larvae)

Soil borer arthropods were found in all blocks, from upper to lower. However, the most notable soil borer for soil health indicator, which is the earthworm, was only observed in block two. Soil borers of Class Diplopoda or Millipedes were observed in all blocks, the third block has the most abundant with 17 individuals. Moreover, burrowing cockroaches, which has two distinctgroup — brown and black colored, were observed in all blocks. These soil borers also feed on decaying matter. Their main function in the soil, which is to burrow along soil layers, is generally beneficial in promoting soil porosity for roots' deeper penetration and eventually increase soil moisture.

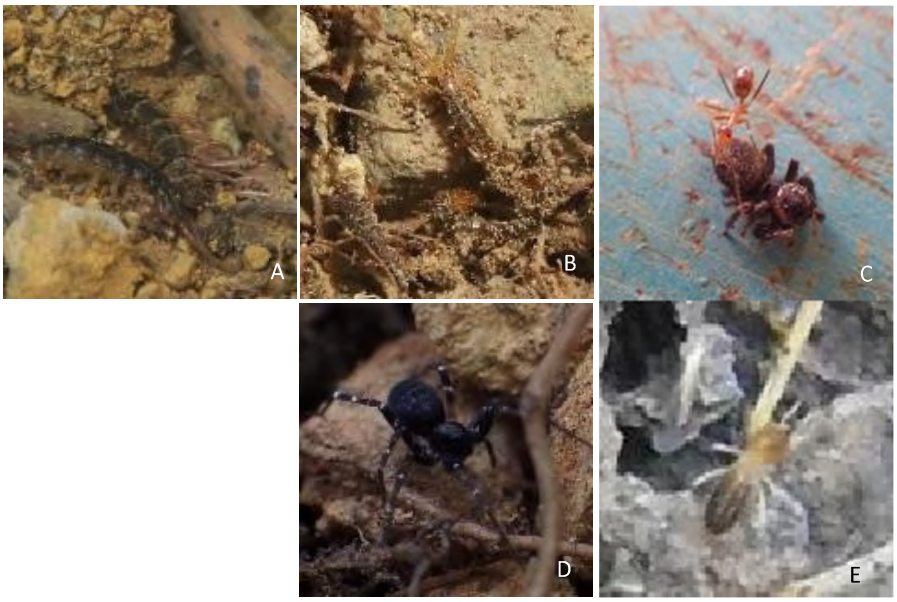


Figure 2.31 Carnivore arthropods: (A-B) Chilopoda (Centipedes); (C)Formicidae; (D) Araneomorphae; and (E) Isoptera (Termite

Carnivorous arthropods contribute significantly to the invertebrate predatory biomass in terrestrial ecosystems. Centipedes (Chilopoda) are among the largest terrestrial invertebrate predators. Among these carnivorous arthropods Chilopoda also burrows in the soil, and also function as soil borer. Formicidae, the ant family, are among the prominent carnivorous arthropod in the site. They generally improve decomposition of dead vertebrate and invertebrateorganisms.

Lastly, detritivore arthropods are the most important decomposers. They basically eat both animal and plant remains, these animals are responsible in converting leaf litter biomass into organic matter that are essential for soil fertility after initial decomposition done by other macro-decomposers. Examples of these are earthworms. It should be noted however, that despite the adversity of the conditions of the site, these soil arthropods are slowly making a come-back. The challenge for improve ecosystem rehabilitation is to improve its population densities that would sustain and bring a balanced organic matter content for the soils.

Figure 2.32. Detritivorous arthropod species: (A) Diplopoda; (B) *Lumbricus* sp.; (C) Isoptera; (D) Ectobiidae; (E) Formicidae; and (F) Blattidae

Arthropod Survey: Light Trapping. There were thirteen distinct nocturnal arthropods caught during night trapping. Fivedistinct arthropods are classified as moths, two are classified as arachnids, and the other were classified under another taxonomic groups. These arthropods are classified putatively using online field guides.

Figure 2.33 Moths caught using light trap: (A) Crambidae; (B) Lasiocampidae; (C-E) Erebidae

Figure 2.34. Arachnids under Araneae caught usinglight trap

Two distinct arthropods were classified under Araneae family or Arachnids. Both arachnids were caught feeding on other live arthropods caught by the light trap, directly establishing their ecological role as predatory group among arthropods. Six other distinct arthropods were classified — *Parcoblatta* sp. (wood cockroach), Gryllidae (crickets); Astatinae, Pemphredoninae, Agrilinae, and an unidentified arthropod. Generallythese arthropods feed in drying or dead trees and promotes initial decomposition. This function is significant in areas with inadequate biotic communities which are important for decomposition,particularly leaf litters and other plant materials

Figure 2.35. Putatively classified arthropods caught using light trap: (A) Astatinae; (B) Pemphredoninae; (C) Agrilinae; (D) unidentified ; (E) *Parcoblatta* sp. (wood cockroach); and (F) Gryllidae (cricket)

Arthropods function on two of the three broad levels of organization of the soil food web (Lavelle et al., 1995) — they are “litter transformers” or “ecosystem engineers.” Litter transformers of which the microarthropods comprise a large part, fragment, or comminute, and humidify ingested plant debris, improving its quality as a substrate for microbial decomposition and fostering the growth and dispersal of microbial populations. Ecosystem engineers are those

organisms that physically modify the habitat, directly or indirectly regulating the availability of resources to other species (Jones et al., 1994). In the soil, this entails altering soil structure, mineral and organic matter composition, and hydrology. Ants and termites are the most important arthropod representatives of this guild, the latter group having received the greater share of research attention (Lobry de Bruyn et al., 1990).

Flora Assessment

Understorey. Twenty-five species of flora classified as understorey were found in the three blocks. The existing understorey vegetation varies from grasses, ferns, shrubs, lianas, vines and trees. Shown in the table below are the observed floral species for understorey classified into taxonomic families.

Table 2.21 Understorey floral species classification and abundance

Family	Scientific Name	Abundance
Apocynaceae	*Marsdenia rostrata* (Schltr.)	3
Asteraceae	*Mikania cordata* (Burm. F.) *Chromolaena odorata* (L.) R.M. King	197
Celastraceae	*Salacia chinensis* (L.)	2
Davalliaceae	*Nephrolepis hirsutula* (G. Forst.)	122
Euphorbiaceae	*Macaranga tanarius* (L.)	44
Fabaceae	*Acacia auriculiformis* (A. Cunn ex Benth) *Acacia crassicarpa* (A. Cunn ex Benth) *Calopogonium mucunoides* (Desv.) *Centrosema pubescens* (Benth.) *Pterocarpus indicus* (Wild.)	1,928
Gleicheniaceae	*Dicranopteris linearis* (Burm. F.)	3
Marattiaceae	*Angiopteris palmiformis* (Cav.) C. Chr.	22
Melastomataceae	*Melastoma malabathricum* (L.)	189
Meliaceae	*Swietenia macrophylla* (King)	1
Phyllanthaceae	*Antidesma ghaesembilla* (Gaertn.) *Glochidion zeylanicum var. lanceolatum* (Hayata) *Bridelia insulana* (Hance)	4
Poaceae	*Axonopus compressus* (Sw.) P. *Brachiaria sp.* *Imperata cylindrical* (L.) P. Beauv. *Saccharum spontaneum* (L.)	223
Polypodiaceae	*Drynaria quercifolia* (L.) J. Sm.; Hook	35
Rubiaceae	*Canthium dicoccum* (Gaertn.)	1
Rutaceae	*Evodia confuse* (Merr.)	3
	TOTAL	**2,777**

A total of 2,777 plants representing 25 species and 15 families were identified from the total area (0.252 ha). Fabaceae was the dominant family in the site with 5 species, followedby Poaceae with 4 species. In terms of the number of plants individuals per family, Fabaceae was

the dominant in the entire study site with 1,928 trees, followed by Poaceae and Asteriaceae with 223 and 197 plants respectively.

Table 2.22. Abundance of understorey species and diversity index for each block

Species	**Block 1 (Upper slope)**	**Block 2 (Middle slope)**	**Block 3 (Down slope)**	
Chromolaena odorata	101	30	16	147
Acacia auriculiformis	576	454	853	
Centrosema pubescens	30	-		30
Drynaria quercifolia	19	15		35
Nephrolepis hirsutula	22	100		122
Melastoma malabathricum	47	128	14	189
Saccharum spontaneum	121	9		130
Mikania cordata	39	11		50
Marsdenia rostrata		-		
Imperata cylindrica	36	-		36
Swietenia macrophylla		-		
Calopogonium muconoides		-		
Canthium dicoccum		-		
Dicranopteris linearis		2		
Brachiaria sp.		10		11
Glochidion zeylanicum var. lanceolatum		0		
Macaranga tanarius		39		44
Evodia confuse		1		
Acacia crassicarpa		-		
Angiopteris palmiformis		22		22
Antidesma ghaesembilla		2		
Pterocarpus indicus		8		
Axonopus compressus		45		46
Salacia chinensis		-		
Bridelia insulana		-		
Species richness (S)	19	13		25
Abundance (N)	1012	876	889	
Diversity Index (H')	**1.576**	**1.656**	**0.222**	**1.39**
Category	Low	Low	Very low	
Maximum Diversity (Hmax)	2.944	2.565	2.079	3.22
Evenness (E)	0.535	0.646	0.107	0.43

The biodiversity did not varygreatly between the two blocks (1 & 2) but were higher than in block 3 (down slope) since the soil condition in the latter is compacted and canopy cover is relatively open. However, they are relatively low. The lowest Shannon diversity index value was obtained in Block 3 (*H'* = 0.222) whereas the Block 1 and 2 have very close values of 1.576 and 1.656. The diversity of the entire site was also computed, with a value of 1.39, which is comparatively low based from Krohne Biodiversity Scaling System. Its maximum diversity index is 3.22, thus, it has an evenness value of only 0.43.

Species richness showed thatnineteen species were observed in block 1, thirteen in block 2, and eight in block 3. Block 1 has an abundance of 1,012, block 2 has 876, and block 3 has 889.

The dominant species for understorey in the experimental site is *A. auriculiformis*, with an abundance of 1,883. *A. auriculiformis* is also dominant for each experimental block.

Shown in Figure 14 were the documented floral species inside the experimental blocks. Included in thefigures are the two overstorey species – *A.auriculiformis* and *A. mangium*.

It should be noted however that thepresence of ferns and hagonoy (*Chromolaena odorata* (L.) R.M.King & H.Rob.) is a welcome addition to the biodiversity of the rehabilitation area considering its characteristic as known hyperaccumulator of heavy metals. However, malatungaw (*M. malabathricum*) and hagonoy (*C. odorata*) are listed as invasivespecies yet, in the rehabilitation area they significantly encourage the presence of pollinators.

Figure 2.36 Floral species observed inside the experimental plots: (a) Auri (*A. auriculiformis*) (b) Malatungaw (*M. malabathricum*) (c) Mangium (*A. mangium*) (d) Common fern (*N. hirsutula*) (e) Pakong buwaya (*C. contaminans*) (f) Malakape (*C. dicoccum*)
(g) Creeping-tuberose (*M. rostrata*) (h) Agsam (*D. linearis*) (i) Kabkab (*D. quercifolia*) (j) Centrosema (*C. pubescens*) (k) Uoko (*M. cordata*)

Overstorey. A total of 307 individuals belonging to 3 species (> 10 cm) diameter at breast height (dbh) belonging to 2 genera and 1 family were observed in three biodiversity plots were enumerated (Table 10). Mangium (*Acacia mangium*), Narra (*Pterocarpus indicus*) and Earleaf Acacia (*Acacia auriculiformis*) were the identified species.

Based on density, A. auriculiformis had the highest density followed by A. mangium and P. indicus (Table 10). The total stand density was 3,654.76 trees/ha and the highest stand density was observed in Block 3 (1,357.14 trees/ha), whereas the lowest stand density was observed in Block 1 (23.81 trees/ha) thus, the estimated closeness and presence of trees was estimated. The basal area in all the study blocks ranged from 0.62 m2/ha (B1) to 111.66 m2/ha (B1) and the mean basal area for the 3 blocks was 41.96 m2/ha. The differences in the basal area of tree layers within and among the study blocks may be due to differences in altitude, species composition (monoculture), age of trees (young), and extent of disturbances and successional strategies of the stands.

Table 2.23 Species composition, density per hectare and basal area per hectare for overstorey vegetation

Block	Species	Plot Frequency	Frequency (%)	Total BA/ Block (m2)	Density (trees/ block)	Density (trees/ ha)	BA (m2/ha)
B1	*A. auriculiformis*	7	100				
	A. mangium	1	14				
B2	*A. auriculiformis*	7	100			10	
	A.mangium	3	43				
	P. indicus	2	29				
B3	*A. auriculiformis*	7	100				8
	A. mangium	3	43				
	Total	4	307			3654.76	

The importance value of the tree species (Table 11) in B1 revealed that *A. auriculiformis* (IV = 94.77) is the dominant species. This is mainly because the said species is acidic soil tolerant and can survived even in the most degraded area like mined-out areas of Carmen Copper. In addition, *A. auriculiformis* and *A. mangium* are the species being used in the rehabilitation efforts of CCC mined-out areas. Also, the biodiversity plots were established inside the rehabilitation site of Carmen Copper reasons why *A. auriculiformis* revealed as thedominant species

.Table 2.24. Importance value of overstorey vegetation

BLOCK	SPECIES	RELATIVE ABUNDANCE (%)			IMPORTANCE VALUE (IV) (%)
		FREQUENCY	DENSITY	DOMINANCE	
	A. auriculiformis	87.50	97.37	99.45	94.77
	A. mangium	12.50	2.63	0.55	5.23
	A. auriculiformis	58	81.55	92.04	77.31
	A. mangium	25	5.83	5.65	12.16
	P. indicus	17	12.62	2.31	10.53
	A. auriculiformis	70	89.06	83.41	80.82
	A. mangium	30	10.94	16.59	19.18

Biodiversity indices are made to bring the diversity and abundance of species in differenthabitats to a similar scale for comparison and the higher the value, the greater the species richness. The higher values of the diversity indices revealed a forest with high tree species diversity and abundance (Adekunle et al 2013). The low value of Shannon-Wiener index (H'= 0.430) for the entire biodiversity plot indicates that monoculture decreases the potential of a forest to give opportunity to accommodate other life forms that is why integrating the seven climax species might address this problem.

Table 2.25 Abundance of overstorey species and diversity index for each block

Species	**Block 1**	**Block 2**	**Block 3**	
Acacia auriculiformis	76	84	112	272
Acacia mangium		6	16	22
Pterocarpus indicus		13		13
Species richness (S)	1	3		
Abundance (N)	76	103	128	
Diversity Index (H')	**0**	**0.593**	**0.377**	
Maximum Diversity (Hmax)	0	0.477	0.301	
Evenness (E)	0	0.540	0.544	

Trees, an important component of vegetation, must therefore be constantly monitored and managed in order to direct successional processes towards maintaining species and habitat

diversity (Turner 1987; Attua and Pabi 2013). Tree species diversity is an important aspect of forest ecosystem diversity (Rennolls and Laumonier 2000; Tchouto et al., 2006). The rapid inventory of tree species that provides information on diversity will present an important tool to enhance our ability to maximize biodiversity conservation that results from deforestation and degradation. Plant diversity changes are compared in conjunction with human impacts. Certain changes are easy to predict, at least qualitatively. Population sizes when reduced may have deleterious consequences (Sukumar et al., 1992). Hence, the present investigation was aimed at assessing the diversity to provide guide in the management of forested area.

The rehabilitation area of Carmen Copper Corporation holds a relatively young ecosystem for terrestrial diversity. However, the presence of pioneer tree species and thriving of plant species such as *M. malabathricum*, *A. mangium*, and *A. auriculiformis* initially provides a habitat for several avian species and arthropods. However, the soil macro and microorganisms are lesser in the soil, thus, it is difficult to decompose dead plant parts. Insects such as bees and butterflies which are important pollinator were observed in the area.

Conclusion. The rehabilitation area along the Biga Pit in Carmen Copper Corporation holds a low, yeta significant value of biodiversity. Despite being a former mine move-materials stockpile, several pioneer and beneficial species are starting to thrive in the area. Relatively high floral species richness is also a good indicator of positive response to rehabilitation efforts. Primarily, because of the tree planting and rehabilitation efforts of the company, pioneer floral species - M. malabathricum, A. mangium, and A. auriculiformis, thrived in the area and helped in encouraging macro and micro fauna communities to migrate in the area. Eventually encouraging them to thrive and become part of the area's terrestrial ecosystem. The observation of predatory avian species, particularly raptors, is an indication of the presence of their food source and the developed food web in the area. The soil fauna is also slowlydeveloping. The presence of soil arthropods, particularly the millipedes, centipedes and earthworm, is an indicator of soil development.

Recommendation. Pursue the conduct of other research and development studies in the area by integrating fruit-bearing plants and other species which can provide food to birds and other wildlife species and enhance the biodiversity of the area. There is a need for conservation of existing species to help in the rehabilitation, together with control of invasive species which are currently helping in the development of the young ecosystem

Impacts Mitigation and Enhancement

Potential Impacts of the project on Terrestrial Fauna. Mining activities such as access road construction, exploration drilling, tailings and smelter emissions causes direct impacts such as: land clearance, water contamination and air and noise pollution. These impacts are easy to confirm and assess while the indirect impacts brought about by changes in the environment are not readily evident. Because of this, mining, despite its importance, is often questioned in favor of conserving biodiversity (IUCN and ICMM 2004).

Land clearance from mining results to the destruction, fragmentation and loss of habitat which poses great threat to wildlife species and causes imbalance in nature (Gajera et al., 2013). This can result to the disturbance, displacement and removal of wildlife species within the area at peak during the construction and operations phase of the project. Among the species that are likely to be affected are those which are already threatened as listed by IUCN, CITES and DENR in DAO 2004-15. Moreover, endemic species which have a limited distribution may be affected as well. Studies have also shown that among birds, changes in edge and habitat area affects bird diversity, also, area sensitive avifauna and small patches of remnant native forest only support a small number of forest birds (Loyn et al.,

2010). Likely to be affected are specialist species which have a limited capacity in terms of feeding guild. Loss of their habitat i.e. food source will result to lesser structural support which may not be able to support a variety of birds and other wildlife species' niche. A study by Hernandez (2008) revealed that deforestation and more importantly, land-cover change decreases the possible spatial distribution of endemic bird species because of reduced habitat area and prevalence of competitors and parasites.

Studies show that bird counts and the density of birds declined significantly in air and noise polluted forests compared to non-polluted forest sites. It was also cited that air pollution causes physiological and behavioral disturbance among bird species. Noise pollution can cause physical damage to ears, stress responses, flight or flushing responses, changes in foraging, and other behavioral reactions of birds in laboratory conditions (Ortega 2012). In areas of high air pollution, birds have higher breathing rate and are more exposed to open air where particles can penetrate deep into the lungs of birds (Qin 2015).

Mitigation Measures for the Potential Impacts. Regular monitoring through annual or semi-annual assessment (wet and dry season) of wildlife species should be done as a mitigation measure against the identified potential impacts. Birds may be prioritized to assess since they are said to be good indicators of habitat quality. They respond to habitat functions and there are species which are sensitive to habitat conditions (BirdLife International). Among the parameters to be monitored should be: 1.) diversity indices (i.e. species richness, evenness and dominance); 2.) Abundance and richness of endemic and threatened species listed in IUCN, CITES and DENR in DAO 2004-15 and 3.) Species count/population studies of keystone species which other species depend on for biological necessities. These keystone species include: seed dispersers (e.g. fruit bats and fruit doves) and top predators (raptorial birds, and snakes).

Buffer zones should also be clearly designated as no-take zones to enhance the conservation value of the area amidst mining and habitat fragmentation (Sayer, 1991). This provides assurance for the refuge of displaced species as well structural support for various niches of wildlife species. Employment of progressive rehabilitation of local species can also be done. These rehabilitated areas can serve as critical corridors for birds and other wildlife species travelling across the fragmented habitat in the area. It also suggested rehabilitating first the mined-out parcel of land before mining another parcel to minimize fragmentation as much as possible.

It is further recommended to construct a temporary shelter for accidentally captured species including those that pose threat to workers and the local community. It is also prescribed to have an on call veterinarian to attend to the wildlife species in the area.

Lastly, mining improves accessibility to certain areas which may be taken for granted by illegal hunter/poachers. With this, increased security in the area should be done to apprehend violators. Moreover, IEC materials about the importance of wildlife conservation may be distributed to increase awareness and knowledge of the local community

Possible Threats to Flora due to the proposed Project

Different stages of mining posed different threats to local floral assemblage of a site. One of the most prominent effects is the clearance of the forest to give way for the construction of mine facilities and for the actual extraction phase of the project.

As early as the exploration and and initial investigation of the site, there are minimal effects to the flora of the site. This includes clearing of patches of plants to give way for ocular investigations.

The most abrupt effect of the mining project to the site forest will be during the construction phase wherein clearance of the forest is expected. Clearance is usually deemed necessary in the construction phase since road and facilities constructions are expected to be completed on this phase of the mining project. Extensive plan on the clearance of the forest is essential since it is vital to prevent unnecessary damages to the forest.

During the operations phase, more clearance of the forest is expected since parcels will be activated for extraction of the ores. Other facilities such as settling ponds will be operational and will consume significant area of land. Since damages to the local ecosystem are expected, maintenance of buffer zones in the circumference of the damaged area is needed. These buffer zones must be designed to neutralize the effects of the mining activities, thus preventing the effects to reach other parts of the forests. One of the major example of these are riparian buffer ones. These buffer zones are designed to prevent the damages of the mining activities to reach the streams and rivers. Usually, a layer of riparian vegetation is left untouched to serve as the buffer zone of the area.

Impact Management. Plants that are already listed on the list of threatened species must be taken into prime importance for the conservation efforts of the mining sites. Determined species must be the focus of the nursery operations. For example, Arius (Podacarpus costalis) that was observed on T1 can be a source of material for further propagation of the species. Other vulnerable species must also be taken into consideration in the nursery operations aside from the reforestation species.

Progressive rehabilitation of the damaged parcels must commence once a parcel is declared mined-out. Conservation of the local biodiversity must be incorporated on the progressive rehabilitation strategies. This can be done by using a mixture of known reforestation trees such as the leguminous plants that are capable of nitrogen-fixing i.e. Mangium (Acacia mangium) and Auri (A. auriculiformis) with other indigenous trees that were determined to be part of the original landscape of the area. Re-vegetation of most mining areas involves different considerations due to the changes in the physical and chemical conditions brought by the mining operations. The land topography, for example is drastically changed by mining operations. The necessary flattening and alteration of the original slope for the mines' access roads, conveyor system, settling ponds, etc. requires different conditions for the selection of species for rehabilitation.

Aside from trees, other smaller plants such as shrubs, herbs, ferns and grasses can help in reforesting the area. As discussed on the floral composition of the mining sites, different understory species can be found on the area. This will also ensure diversity of species found on the area. From the ecological succession model, grasses and smaller plants are first plants to spring naturally in a damaged area.

One step to prevent physical erosion of steep slopes is by planting grass species. Introduction of the species that hastens the recovery of the forest dynamics such as nutrient cycle provided resultant rehabilitation of the site, however, local species present in the areas must be considered to be planted as well. Grasses like vetiver (Chrysopogon zizanioides) are often used in mining rehabilitation since it can easily grow in barren lands and even in slopes. According to the Research Compendium on Mining and Volcanic Area, vetiver grass is often used since it has stiff and erect stems which can stand up to relatively deep water flow (0.6-0.8m). It also forms hedges when individual plants form a cluster. These hedges are good filters of soil and water since they are capable of reducing water's flow velocity and diverting surface run-off.

Bamboo species are also known to be effective in mine rehabilitation. It is noted that Boho, (S. lumampao (Blanco) Merr) was found in abundance in some of the studied transects. Bamboo species are noted for their stability and dense root systems.

The Toledo Copper Mines has substantial areas with remaining forest cover/woodland *(see Figure 2.34)*, reforested and rehabilitated sites, and areas currently undergoing and program for rehabilitation and reforestation in the years to come (see Fig. 4.5). The ATCOM old plantation covered an area of

172 hectares, while the CCC reforestation program from 2007 to 2022 (as of ____) already were able to cover 586.02 hectares. See Table 2.26

The land cover map for the entire City of Toledo *(Figure 2.38*) indicated the predominance of perennial crops, shrubs and wooded grassland, with the open forest located in the vicinity of the TCM

Table 2.26 Reforestation Program, Area Planted

	PERIOD	Area Planted (has.)
1	2022	13.00
2	2017-2019	41.09
3	2007-2021	531.93
4	ATCOM Old Plantation	172.00
	TOTAL	**758.02**

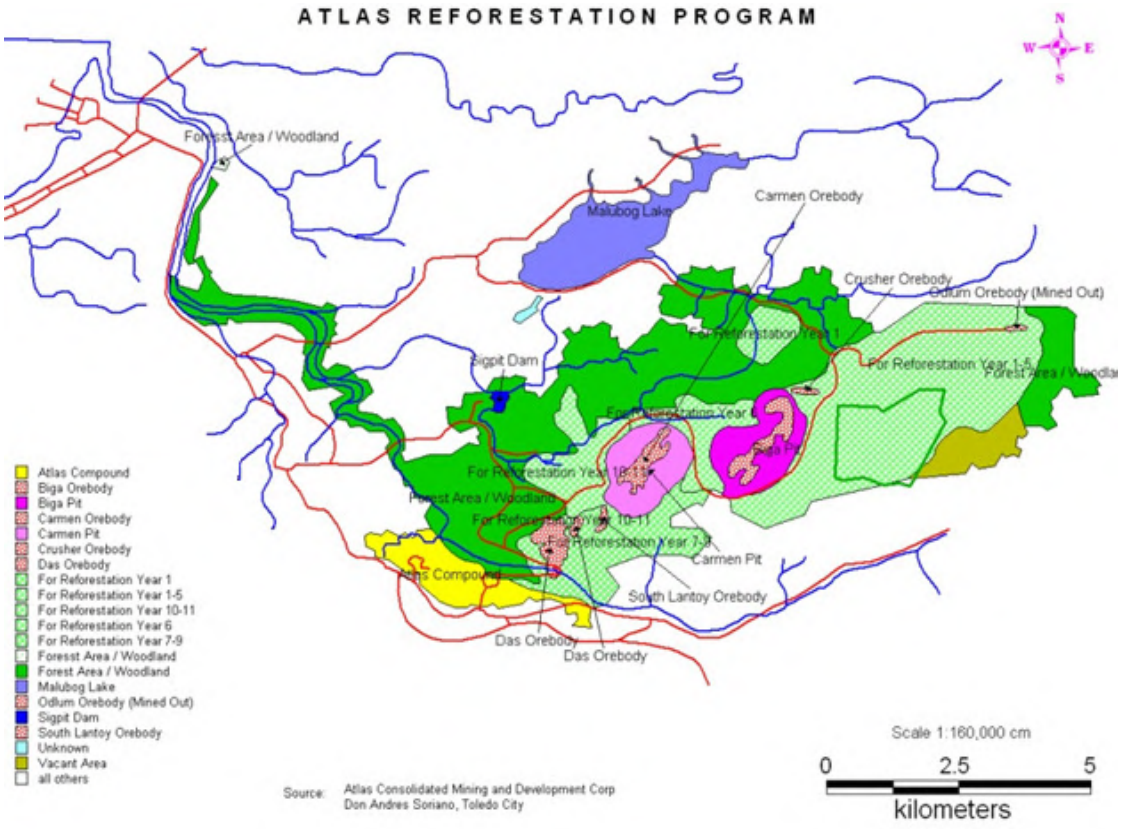


Figure 2.37 **Map of Toledo Copper Mines Reforestation Program, 2011**

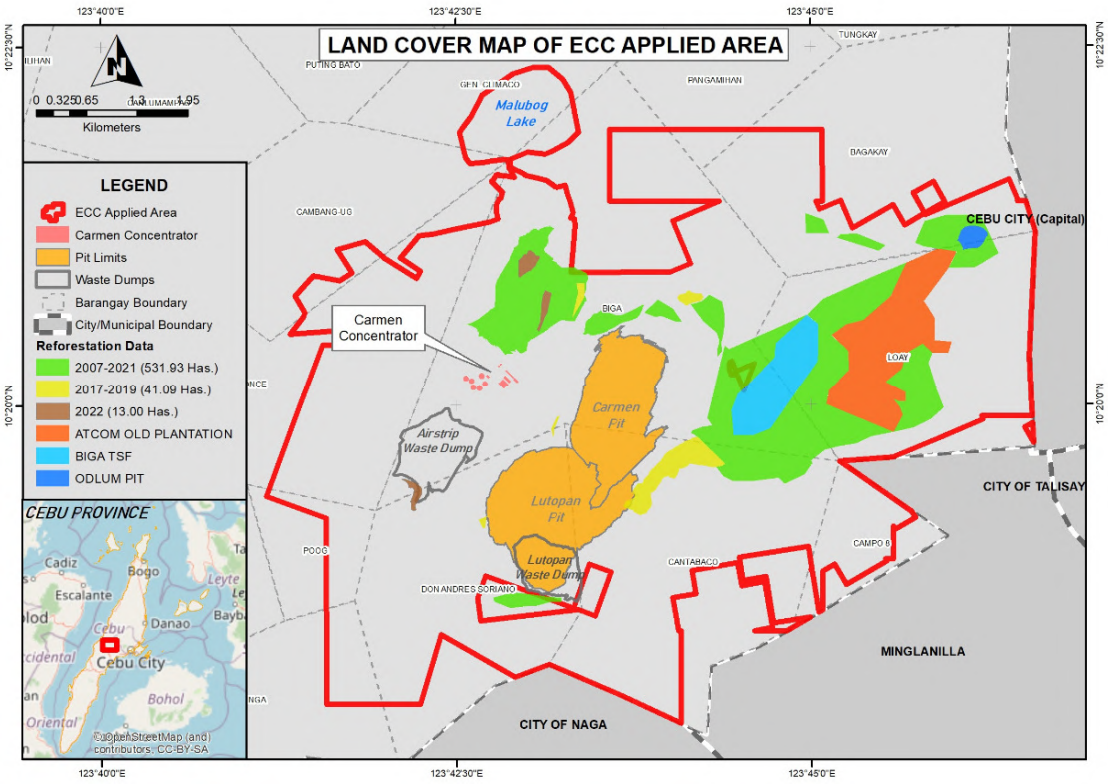


Figure 2.38 TCM Reforestation Program

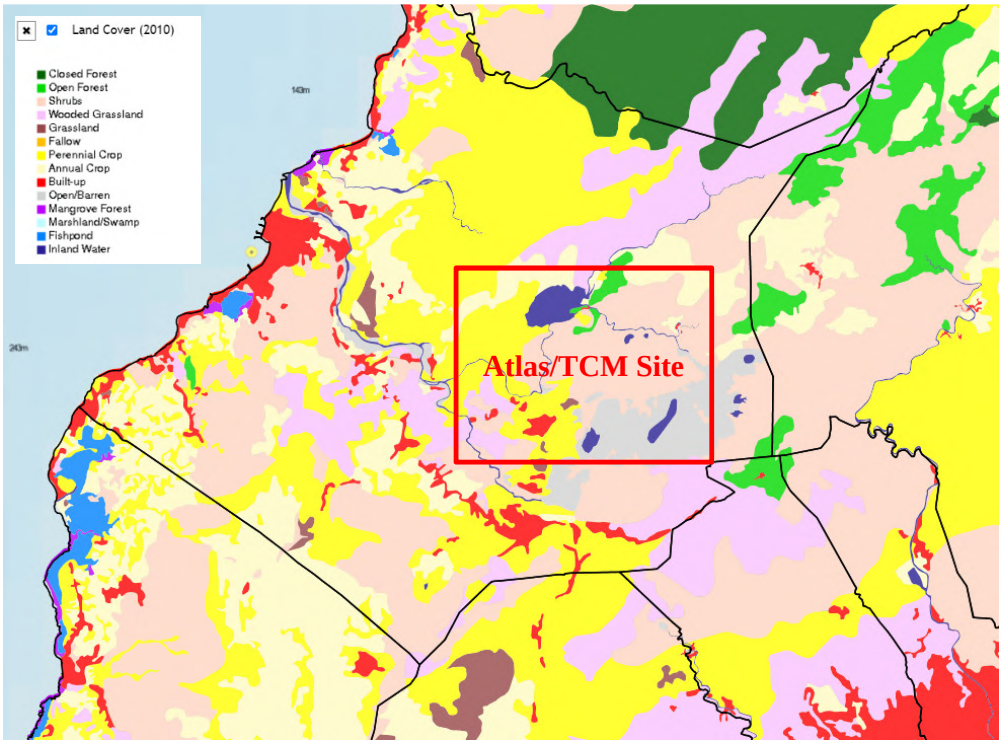


Figure 2.39 Land Cover-Toledo City (2010)
Source: geoportal.gov.ph

Tree species to be planted

Auri and Mangium will be the majority of tree species that will be planted. These species are adapted to low pH, and metal laden soil. It will serve as nurse trees. Through time the microclimate of the area will positively change and making it conducive to the group of prioneer native species.

Table 2.27 Seedlings Planted and Survival Rate

YEAR	Accomplishment					
	Seedlings produced	Seedlings planted	Target (Has.)	Accomp (Has)	%	Survival Rate
2007	11,928	4,738	5.00	2.84	57%	91.00%
2008	34,503	20,646	15.00	12.39	83%	92.00%
2009	38,763	18,019	15.00	10.81	72%	89.00%
2010	45,474	41,119	15.00	24.67	164%	94.90%
2011	83,914	90,672	25.00	54.39	218%	98.00%
2012	313,916	243,993	125.00	146.37	117%	96.01%
2013	247,740	150,898	75.00	90.52	121%	97.68%
2014	62,590	16,790	10.00	10.07	101%	95.30%
2015	66,746	42,415	25.00	25.44	102%	87.63%
2016	78,134	42,008	25.00	25.20	101%	90.60%
2017	52,530	15,817	10.00	9.49	95%	91.20%
2018	58,780	27,835	15.00	16.16	108%	87.65%
2019	54,890	38,282	15.00	15.31	102%	88.92%
2020	328,942	251,371	100.00	100.55	101%	87.91%
2021	42,650	35,899	15.00	14.36	96%	88.30%
Total	**1,521,500**	**1,040,502**	**485.00**	**558.57**	**115%**	

BIODIVERSTIY STATUS

The results of the Rapid Biodiversity Assessment (ERDB, 2018) has noted that the "rehabilitation area along the Biga Pit in Carmen Copper Corporation holds a low, yet a significant value of biodiversity. Despite being a former mine move-materials stockpile, several pioneer and beneficial species are starting to thrive in the area. Relatively high floral species richness is also a good indicator of positive response to rehabilitation efforts. Primarily, because of the tree planting and rehabilitation efforts of the company, pioneer floral species - *M. malabathricum*, *A. mangium*, and *A. auriculiformis*, thrived in the area and helped in encouraging macro and micro fauna communities to migrate in the area. Eventually encouraging them to thrive and become part of the area's terrestrial ecosystem. The observation of predatory avian species, particularly raptors, is an indication of the presence of their food source and the developed food web in the area. The soil fauna is also slowly developing. The presence of soil arthropods, particularly the millipedes, centipedes and earthworm, is an indicator of soil development."

Measures for Terrestial Flora and Fauna. The FMRDP 2010 contained the 'Fauna Habitat Management' which, in general terms, addresses the effects of mining activities (inclusive of the proposed Toledo Copper Mines TSF) on fauna habitat within the Toledo Copper Mine site, as follows: *Floristic and structural diversity in the vegetation, including the presence of fauna habitat at ground level is important for faunal recruitment/recolonization and habitation. Thus, rehabilitation measures will include the re-instatement of fauna habitat as a combination of protective logs and*

vegetation debris mounds and trails. The replacement of habitats is aimed at increasing structural complexity during the early stages to provide additional niches that will encourage recolonization and dispersion of native fauna. Following are the important measures to undertake related to this aspect:

- *Stockpile location for habitat vegetations/logs/cuttings that will be collected from the clearing operations shall be delineated outside the mine path.*
- *Construct at least one fauna habitat per 10 hectares of mine disturbed sites by placing stockpiled habitat vegetations/logs/cuttings. Enrichment planting of the immediate surroundings of the established habitat shall be initiated to accelerate plant species diversity and thus establish diverse niches.*

ESTABLISHMENT OF THE TOLEDO COPPER MINES ECOPARK

Rationale. With the resumption of the mining activity of the Toledo Copper Mine a number of wildlife had been impacted. Various types of wildlife which includes; birds, snakes, monkeys, flying lemurs, wildcats, wild chickens and a lot more where displaced on their natural habitat during the course of mining. Native trees were also affected and to be affected of mining operations. Some of the trees growing in the mining site are premium trees. As per informal interview of the settlers at barangay Biga, Bayong and Ipil were present before. These species are now rare in the Philippines and is considered as premium trees. Continues dumping of waste materials on already vegetated sites whether natural or through reforestation efforts has corresponding impacts to wildlife therein. To mitigate this foreseen impact and as an environmentally responsible mining operator it is imperative to take care of the organism living in the mine site.

With the above scenario, a small ecological park will be established to serve the purpose. This will be developed at the vegetated Carmen, Supervisory, West duplex compounds and Abaca area. With the following objectives;

Objectives:

1. To provide favorable habitat for the displaced wildlife brought by mining operations.
2. To develop the area into a small educational eco-park that will serve as a window for people's appreciation of the native, indigenous trees that can hardly be found nowadays.
3. To have a place where people can enjoy, relax and commune with nature.

Component/Strategies

- **Plant Arboretum** –This will be the main attraction of the site. This will house indigenous forest species with more emphasis on the premium, rare and dipterocarps trees. For environmental education purposes, trees and other indigenous plants will be labeled. Said area may be utilized as a park where families can enjoy the forest ambience but in a controlled manner. Looking into the carrying capacity of the site and the impact it will cause into the system.
- **Animal Rescue and Breeding Center** - sick, injured or orphaned wildlife animals in the mining area will be cared on this facility. It will be released when the wildlife is ready and healthy enough to survive in the wilderness. This facility will also serve as breeding area for wildlife. Offsprings will be released when it is mature enough to live by its own. Moreover, if funds will allow, some wildlife housed at the DENR camp 7 rescue center may be adopted and will serve as initial breeding stocks. Discussion about this idea was already done. DENR is just waiting for individuals or institution to write their intention to adopt the wildlife at their rescue center.
- **Wildlife Foodplants** – an area will be set-aside for the growing of identified food plants of known existing wildlife in the mine site. Selection of food plants will be carefully studied taking into consideration continues supply of wildlife foods all year round.
- **Ecotrail –** A meandering walkway will be made to **provide visitors an opportunity to develop awareness, appreciation and understanding of forest environment as well as corresponding wildlife living within.**

- **Butterfly garden** – To add more beauty, a butterfly garden will be established. This garden will highlight various flowering food plants and the butterflies per see. This will provide a place for people to appreciate the beauty and importance of butterflies. The presence of this beautiful insect in an area is an indicator of good ecological health for these are sensitive to changes in the environment.
- Additional attraction may be **growing of orchids** on the tree branches.
- Informative **guided tours** will be available to guests. A trained guide will provide valuable insight about what will be seen in the area. Guide shall be well verse on biological systems and processes of a forest and forest wildlife.
- Establishment of **kiosk** made of native materials. This will be available to visitors as resting place and picnic area. The number of kiosk will be controlled based on carrying capacity of the site.
- Converted supervisory swimming pool into **fishpond**. Fish can be bait with a fee.
- Survey and delineation of the site must be done. Approval from the management to utilize the area as eco-park shall be acquired.

Project Management. The eco-park will be implemented by the Environment Department through its Wildlife officer who shall oversee the operation of the project. He will be under the supervision of the Reforestation Section Manager. An animal health graduate with at least 3 years experience in the mentioned field will be hired and assigned to supervise the area and activities therein. Likewise additional rank and file personnel shall be employed to provide maintenance and assistance. Strict implementation of wildlife act shall be implemented on this area as well as the entire Atlas Property that will be carried by our security department and deputized PO members.

REFORESTATION/REHABILITATION PROGRAM

Table 2.28; Timetable for the Progressive Mine Rehabilitation of Disturbed Areas for 2022

Activities	UWM	Target	Monthly Target											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Seedling production and management														
- Forest seedlings	Seedlings	28,756	3,960	3,960	3,960	3,960	3,960	3,960	2,496		2,500			
- Grasses		2,875											2875	
2. Plantation establishment (trees and grasses)														
a. Blocking	Has	15			15									
b. Lay-outing and Staking	Stakes	25005			12,503	12,502								
c. Hauling of seedlings	Seedlings	25,005					3,960	3,960	3,960	3,960	3,960	3,960	1,245	2,500
d. Hole Digging	Holes	25,005					3,960	3,960	3,960	3,960	3,960	3,960	1,245	2,500
e. Planting	Seedlings	25,005					3,960	3,960	3,960	3,960	3,960	3,960	1,245	2,500
3. Plantation maintenance														
a. Replanting	Seedlings	3,750												4,745
b. Ring Weeding	Hills													4,745
c. Fertilizer application	Seedlings													4,745
Note:														
* 15 % seedling mortality allowance														

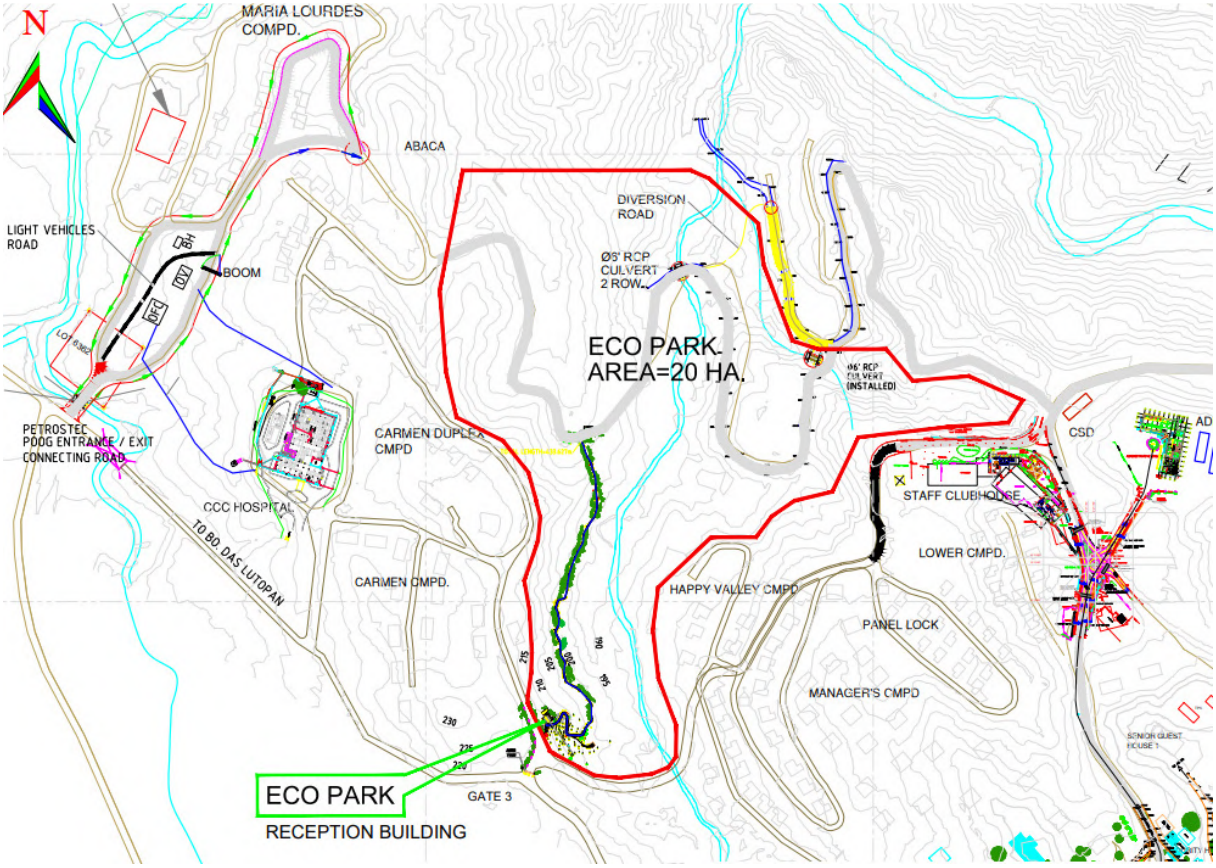


Figure 2.40 EcoPark Development Plan

2.2 Water

2.2.1 Hydrology/Hydrogeology

Water Balance and Drainage Catchment Run-off Volume[18]. The in-house project was conducted to generate input data on the identification of streams, tributaries, rivers and ponds that constitute the natural drainage system of the Atlas/CCC watershed and the qualification of the volumetric flow rate of each of these water bodies as they course into and out of the mine site. The survey result shall serve as future baseline reference that could be utilized in environmental profiling and monitoring of water-borne effluents and similar impacts generated by the forthcoming Atlas/CCC's mining operations.

The goal of the survey is to account and quantify the individual flow rates of the identified water bodies that comprise the natural drainage network of the Atlas/CCC watershed.

The initial flow measurement which took approximately 15 days to complete was started on February 20, 2007 and finished on March 7, 2007. The most recent flow measurement was made last June 2011. Flow rate measurements commenced with the Ilag River channel and its tributaries. Thereafter, the team surveyed the course in the north. Finally, the team measured the flow rates of the water courses outside the company premises, specifically the Buswang convergence point and the inflow feeding into the Sapang-Dako River.

The second flow measurement was conducted from August 8, 2007 to August 15, 2007. The same method and route taken during the initial flow measurement were observed on the second measurement. The survey computations, assessment, and results are presented hereunder:

Table 2.29 Summary of Water Balance Survey

Location	Coordinates	Volumetric Flow Rate (August 2007)	pH	Volumetric Flow Rate (Feb.-March 2007)	pH	Volumetric Flow Rate (June 2011)	pH
Upstream of Diversion Intake (Masaba area)	N 10° 18' 37.7" E 123° 43' 19.4"	777.6 cfm / 5,832 gpm	7.1	419.94 cfm (2/20/07) / 3,141.37 gpm	7.7	1,293.205 gpm	7.53
Upstream PAMA SAG	N 10° 18' 54.5" E 123° 43' 0.2"	28.46 cfm / 213.45 gpm	6.4	8.40 cfm / 62.84 gpm	7.2	1,555.35 gpm	7.55
Creek from West Duplex and ACMDC Hospital	N 10° 19' 12.4" E 123° 42' 3.5"	116.64 cfm / 872.46 gpm	7.3	73.19 cfm / 547.50 gpm	7.9	1,565.224 gpm	8.39
1st Creek from Airstrip (Upstream Abaca WTF)	N 10° 19' 13.4" E 123° 42' 2.2"	36 gpm	3.9	0.32 cfm / 2.39 gpm	3.6		
Abaca Pump Hause	N 10° 19' 17.1" E 123° 41' 55.6"	15.84 gpm	7	17.21 cfm / 128.73 gpm	8.2	3,906.626 gpm	7.99
Poog Stream	N 10° 19' 12.9" E 123° 41' 55.6"	157.24 cfm / 1179.30 gpm	6.9	47.38 cfm / 354.43 gpm	7.9	2,040.835 gpm	8.17
2nd Creek fr Airstrip (Down stream Abaca WTF)	N 10° 19' 20.8" E 123° 42' 1"	1,459.55 cfm / 10,946.67 gpm	6.4	1.12 cfm / 8.38 gpm	3.5		
Ilag	N 10° 19' 22.2" E 123° 42' 1"	559.77 cfm / 4,198.27 gpm	6.7	510.74 cfm / 3,820.60 gpm		4,950.234 gpm	7.92
Creek fr Udlom/ Khyber Pass	N 10° 19' 28.1" E 123° 42' 1.4"	155.4 cfm / 1,165.2 gpm	3.9	55.14 cfm / 412.48 gpm	4		
Pandong Bato Area	N 10° 19' 22.2" E 123° 42' 1"			283.36 cfm / 2,119.68 gpm	7.5	8,803.898 gpm	8.1
Downstream of Malubog Dam	N 10° 21' 37.7" E 123° 42' 33.8"	1,452.84 cfm / 10,896.27 gpm	6.1	742.44 cfm / 5,553.84 gpm			
Hinulawan River (UPPER SIGPIT)	N 10° 20' 38.7" E 123° 42' 29"	1,123.22 cfm / 8,424.14 gpm	6.6	464.46 cfm / 3,474.40 gpm		12,612.6 gpm	7.74

[18] CCC (December 2011). Atlas Mines Tailings Disposal Facility-Amendment.

Carcon Creek	N 10° 20' 25" E 123° 42' 19.6"	162 cfm / 1,215.04 gpm	7	75.44 cfm / 564.33 gpm	8.1	4,348.052 gpm	7.94
Carcon Pump Haus fresh water	N 10° 20' 29.7" E 123° 42' 29.6"			161.80 cfm / 1,210.35 gpm	8.2		
SBDT Portal		274.11 cfm / 2,055.82 gpm	3.9	276.03 cfm / 2,064.85 gpm	3	220.0769 gpm	5.5
SBDT Carcon Creek outflow	N 10° 20' 38.5" E 123° 42' 26.4"	655.82 cfm / 4,918.65 gpm	6.6	403.2 cfm / 3,016.15 gpm	3.4	221.573 gpm	7.43
Buswang River (LOWER SIGPIT)		**3,005.70 cfm / 22,542.75 gpm**	**7.1**	**2,413.86 cfm / 18,056.93 gpm**		**18, 104.73 gpm**	**7.44**
Bigacon Creek	N 10° 21' 23.3" E 123° 44' 56"	2.12 cfm / 15.86 gpm	7.7	7.41 cfm / 55.43 gpm	8.1		
Cumba River	N 10° 21' 34.3" E 123° 44' 52.6"	646.88 cfm / 4,851.63 gpm	6.2	673.10 cfm / 5,035.14 gpm	7.2	10,302.55 gpm	5.96
Pangamihan Creek	N 10° 21' 45.8" E 123° 44' 20.5"	84.38 cfm / 632.88 gpm	7.9	31.10 cfm / 232.64 gpm		1,976.278 gpm	4.24
Guinquiotan, near silt dam leading to Malubog Basin	N 10° 21' 45.8" E 123° 44' 20.5"	971.21 cfm / 7,284.08 gpm	7.9	761.59 cfm / 5,697.07 gpm			

The outfall of the overflow pipeline will be the Buswang River (Lower Sigpit), which had the lowest flow rate of 2,413.86 cfm and a high of 3,005.70 cfm in the above-table. The additional 17,500 m³/day or 429.2 cfm discharge of the Biga Pit Relief-Overflow pipeline would still be within the ranges of the measured flow rates of the Buswang (Lower Sigpit) River.

Drainage Catchment Run-off Volume. A conservative estimate of the run-off volume of Upper and Lower Sigpit River indicated a run-off volume of 50,220 m³ and 79,740 m³ (total of 129,960 m³), respectively, for an average (normal) rainfall of 0.18cm (*See Figure below*). The highest recorded rainfall of 1.92 cm were in November of 2009 and 2010 (*See Sigpit Rainfall Data on p.___*). The 17,500 m³/day discharge of the Biga Pit Relief-Overflow pipeline could still be accommodated by the outfall-Lower Sigpit River and eventually the larger/wider Sapangdaku River

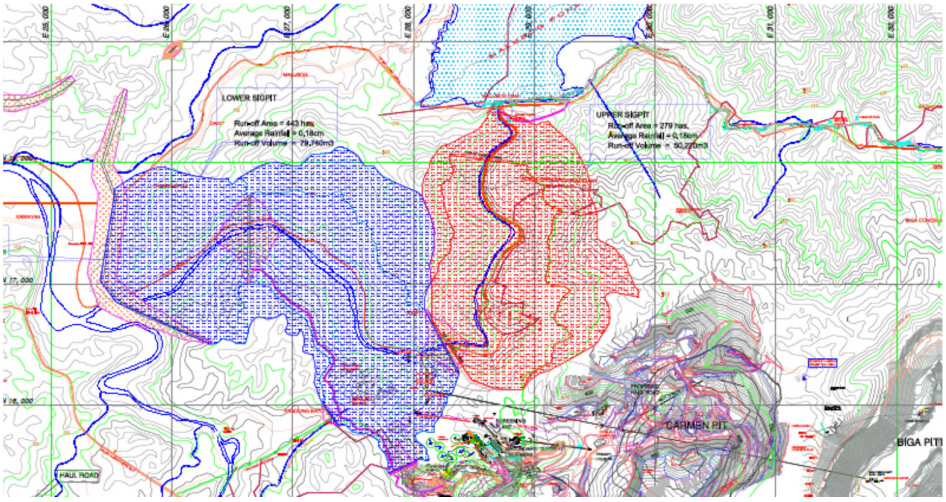


Fig.2.41 Upper and Lower Sigpit River Run-off Volume

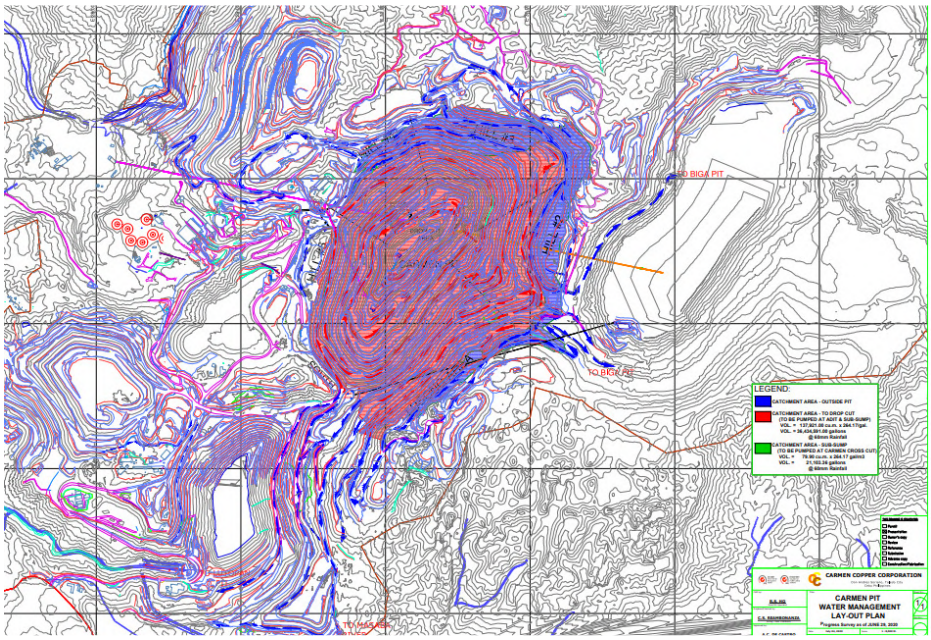


Figure 2.42 Stormwater Flow/Drainage of BTSF catchment area

2.2.2 Oceanography

Oceanography[19]

Winds and Weather. The general climate of the Philippines is, for the most part, governed by three main air currents: the Northeast Trade Wind, the Northeast Monsoon, and the Southwest Monsoon. Squalls are somewhat prevalent during the Southwest Monsoon, particularly near the land. During such squalls the wind gust may reach gale force. These squalls are often associated with thunderstorms. Strong and squally southwesterly winds called Collas sometimes blow for several days in summer and early autumn. This phenomenon is generally associated with typhoons centered some distance to the North and accompanied by rain.

The land and sea breeze effect is well marked in coastal waters, particularly when and where the prevailing monsoon is weak. Topography may modify the prevailing winds. The climate in the area covered by this sector is normally warm and humid. Maximum temperatures occur in April, May, and June with December, January, and February being the months of minimum temperatures.

The area is influenced by the reversing wind pattern of the Asian monsoon (Wang et al 2000). From November to early March, strong winds from the northeast (northeast monsoon) predominates, while from July to September, strong winds blow from the southwest (southwest monsoon). However, the study area is partially sheltered from the northeast monsoon due to the high mountain ranges in the central part of the island. Winds during inter-monsoonal months (April to June and October) are weaker and more variable in direction.

Comparatively high values of relative humidity are observed, with minimum values generally occurring around March and April. In this area the seasonal variation of humidity on the whole follows that of rainfall, highest values occurring from September to January.

This part of the island has no pronounced maximum rain period, and has a short dry season lasting from 1 to 3 months. Central and South Cebu have practically the same prevailing conditions. During the

[19] Arregadas (2018)

short dry season, days with rain generally average between 4 to 10 a month, while 15 to 20 a month may be expected during summer and autumn.

From October or November to April, the Northeast Monsoon is usually fresh from the North and blows straight down the axis of Tanon Strait. It is seldom troublesome in the strait South of Pasil Point.

At the end of May, the winds of the Southwest Monsoon begin to blow. They become established in a month and terminate in October. They bring rain squalls and storms which occur principally in July, August, and September.

During July and August, squalls and southwesterly winds of the outer zones of typhoons affect the area. During these months there are frequently periods of clear weather with southerly and southeasterly breezes. In September and October fine weather prevails.

The South end of Tanon Strait is protected from the Southwest Monsoon by mountains, and it is only when the wind is strong that it is felt in the strait. It is always stronger at the North end and like the Northeast Monsoon, it blows along the axis of the strait. Usually a quiet sea prevails in the Tanon Strait.

The Northeast Trade Wind predominates during March and April, and often during February and May as well. It is of moderate strength and is the driest of all the winds affecting this area. In general, wind velocities are very moderate, reaching 30 knots or more only during thunder squalls, or when associated with tropical storms.

During the Northeast Monsoon, the sea rises along the North coastline of Negros and surf is found along the beaches of the island from the Northern half of Tanon Strait to Tomonton Point. Surf is seldom experienced at the South end of the strait, and is generally very light along the coastline on the Cebu side.

Tides and Currents. Currents in the vicinity of Negros and Cebu are largely tidal. In the Samar Sea the flood current generally sets to the Southwest, among and around the islands, and enters the Eastern part of the Visayan Sea and into Tanon Strait. In the Bohol Sea, a branch of the flood tidal current from Surigao Strait strikes the Southeast coast of Negros off Dumaguete City and divides into two arms, one of which enters the Tanon Strait with great force.

In the Bohol Sea the current produced by the tidal wave which enters Surigao Strait divides into two branches after passing between Panglao Island and Siquijor Island. One branch flows in a northeasterly direction through Bohol Strait, the other flows West striking the Southeastern coast of Negros near Dumaguete City and again divides into two branches, one of which turns South between Negros Island coast and Siquijor Island.

Off Bonbonon Point, it meets the flood from around the South end of Negros Island and both are diverted Southeast towards Mindanao; the other branch enters Tanon Strait. During the ebb the directions of flow are reversed. Combined with the tidal stream in Bohol Strait, there appears to be a non-tidal flow going South which continues past end of the strait toward the South end of Negros.

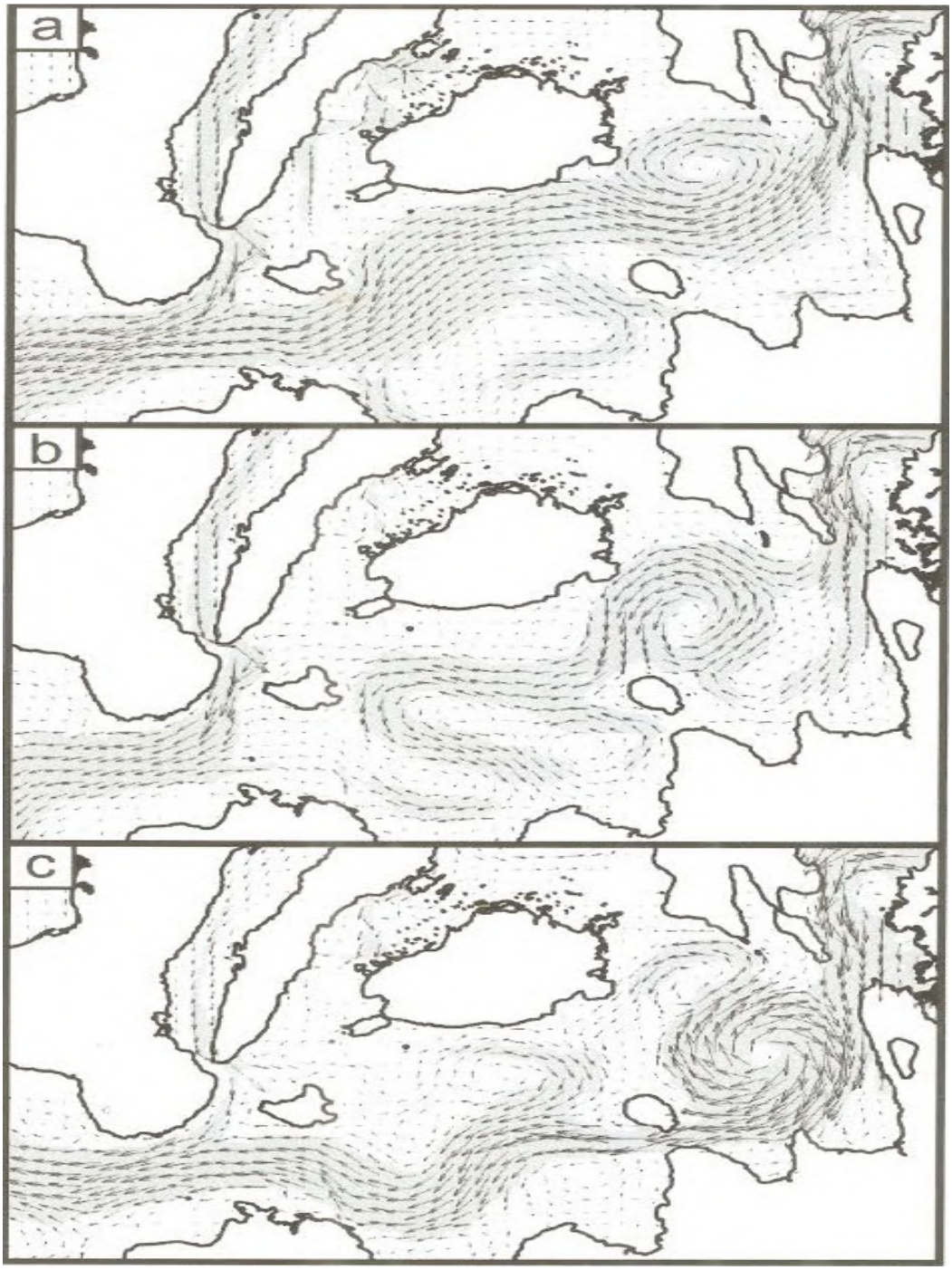


Fig. 2.43: Monsoonal current patterns

Data from the U.S. Navy Layered Ocean Model suggest that the current patterns in the study area are partially influenced by the monsoons. Throughout the year, the general direction of current is south/southwest because of the strong mainstream currents that flow from the Bohol Sea and the Tañon Strait to the Sulu Sea. On average, these currents are strongest during the north-east monsoon, slightly weaker during inter-monsoonal periods and weakest during the southwest monsoon.

Annual trend in current represented by three months: (a) January. (b) May and (c) August is presented in Fig. 3. January represent current patterns for six consecutive months of the year (November to April), coinciding with the northeast monsoon wind, May represent current patterns for inter-monsoonal and

August for the southwest monsoon (June to September) periods. Velocity vectors were averaged from a 3-year period of data. Strongest currents (>0.10 to 0.80 m/sec^{-1}) are highlighted in grey) with maximum average velocities estimated for January, May and August at 0.80, 0.60 and 0.47 m/sec $^{-1}$, respectively.

2.2.2.1 Change/Disruption in Water Circulation Pattern, littoral current, and coastal erosion and dsipostion.

There will be no changes or disruption in the water circulation pattern as there will no construction or new development activities in the port area.

2.2.2.2 Change in Bathymetry

There will be no changes bathymetry as there will no construction or new development activities in the port area

2.2.3 Water Quality[20]

2.2.3.1 Degradation of Groundwater Quality

Groundwater generally moves from higher to lower hydraulic head along sufficiently permeable subsurface channels. Groundwater movement is generally influenced either by flow along interconnected interstices between grains of sedimentary deposits, also known as, primary permeability; or along fractures, fissures and solution openings in relatively massive formations (secondary permeability)

Groundwater flow is often manifested by surface water channels such as rivers and creeks from areas of higher to lower elevations. However, structural features such as sub-surface solution openings and fractures occasionally influence and control groundwater water flow patterns that do not conform with surface manifestations.

The Maunsell Study (___) has identified three major types of aquifers found in the area: (A) units in which flow is intergranular; (B) units in which flow is through fractures and solution channels; and (C) units with local or no ground water potential. The proposed TSF site consist both of aquifers A and B.

While aquifer type A is generally considered to be highly productive, the size, sorting and degree of consolidation of the sedimentary deposits influence the ease of ground water movement. In effect, finer grains, poor sorting and more consolidated or well-cemented rocks are often less permeable. These aquifer types are found in areas underlain by alluvial deposits specifically in Brgys. Ilag, Cambang-ug and Magdugo.

The second group (aquifer type B) constitutes mainly the limestone and other highly fractured rock units that accumulate and transmit water through interconnected fissure systems and solution openings. The level of productivity of wells tapping these aquifer systems largely depends on whether fractures and subsurface openings are intersected. Lithologic sequences such as Cantabaco, Cebu and Carcar having limestone formations generally fall in this category.

There is an immense variability of water level depths in the investigated water sources. This may be influence by factors which includes the type of subsurface material, the configuration of the land surface and human intervention largely in the form of mining operations.

[20] CCC (December 2011). Atlas Mines Tailings Disposal Facility-Amendment

The actual groundwater flow in the study area as noted in Maunsell's piezometric surface map, indicated that groundwater flow in the general direction of north-northwest towards the coastal areas of Toledo City.

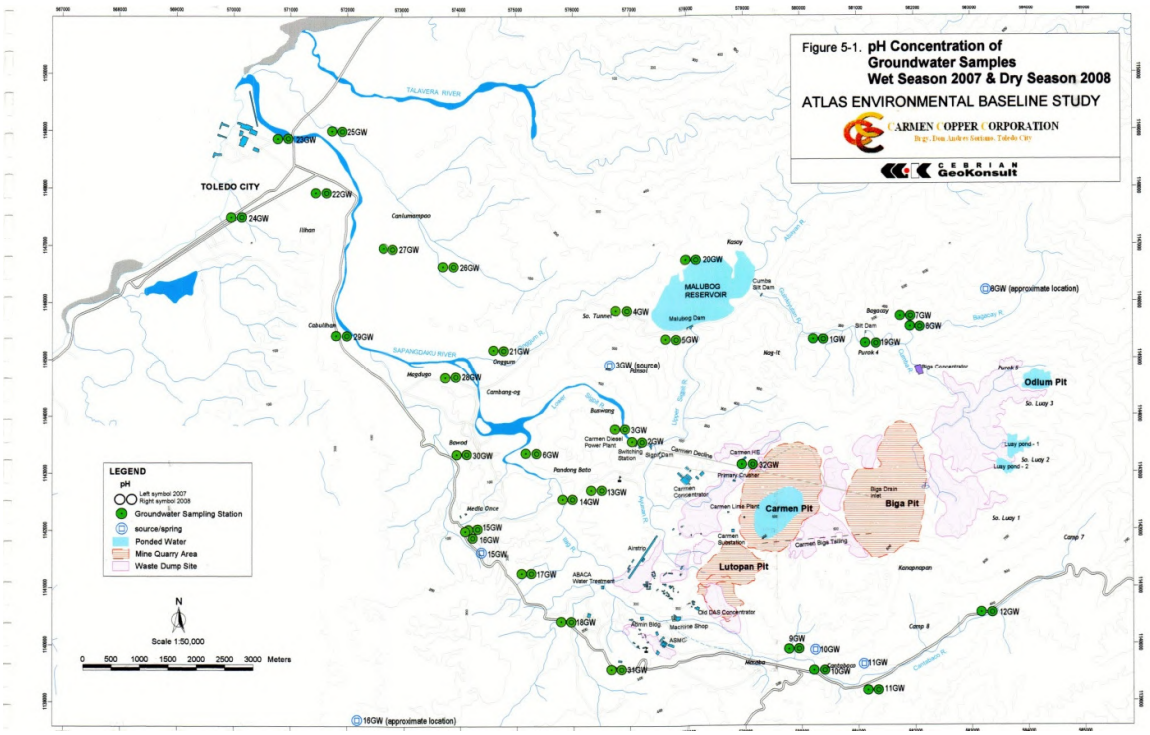


Figure 2.44 **Sampling Points for Groundwater**

Table 2.30 Metal, Trace Metal and Physico-Chemical Concentrations of Groundwater Samples, 2007

Sampling Station			Analysis/Results										
No.	Station	Elev	pH	TSS	TDS	Ar	Cd	Cr	Cu	Iron	Lead	Mer	Zin
1-GW	Bagacay	192	7.4	10	1.564	<.01	<0.02	<0.1	0.05	0.02	<0.02	<0.00045	<0.005
2-GW	Cambangog	70	7.0	<1	413	<.01	<0.02	<0.1	<0.04	<0.02	<0.02	0.0008	<0.005
3-GW	Cambangog	100	7.0	5	518	<.01	<0.02	<0.1	<0.04	<0.02	<0.02	<0.00045	<0.005
27-GW	Canlumampao	19	6.7	<1	1,443	<0.01	<0.004	<0.1	<0.01	<0.03	<0.02	<0.00045	<0.007
28-GW	Magdugo	38	6.9	6	1,377	<.01	<0.004	<0.1	<0.01	<0.03	<0.02	<0.00045	0.9
29-GW	Cabulihan	20	6.8	<1	632	<.01	<0.004	<0.1	<0.01	<0.03	<0.02	<0.00045	0.2
23-GW	AFC, Sangi	55	7.4	<1	364	<.01	<0.004	<0.1	<0.01	0.04	<0.02	<0.00045	<0.007

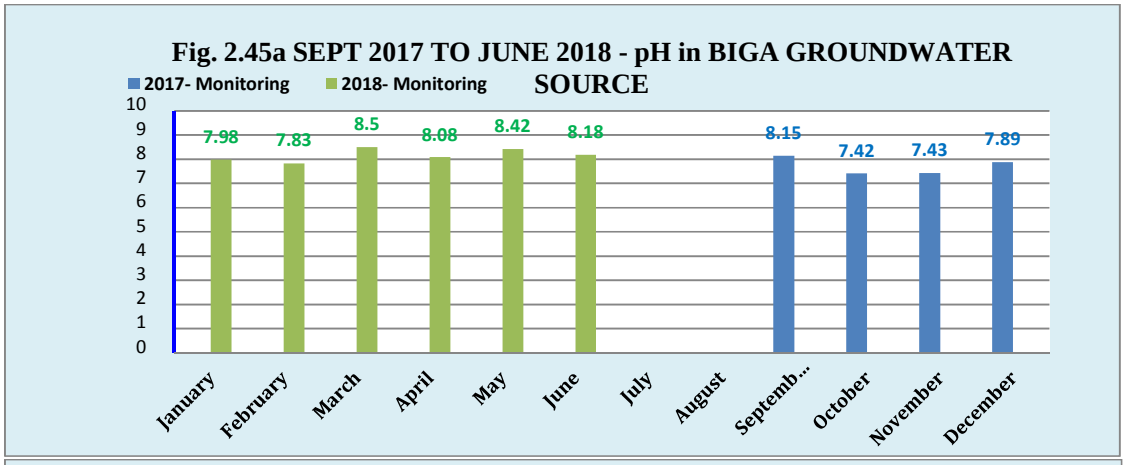
Table 2.31 Metal, Trace Metal and Physico-Chemical Concentrations of Groundwater Samples, 2008

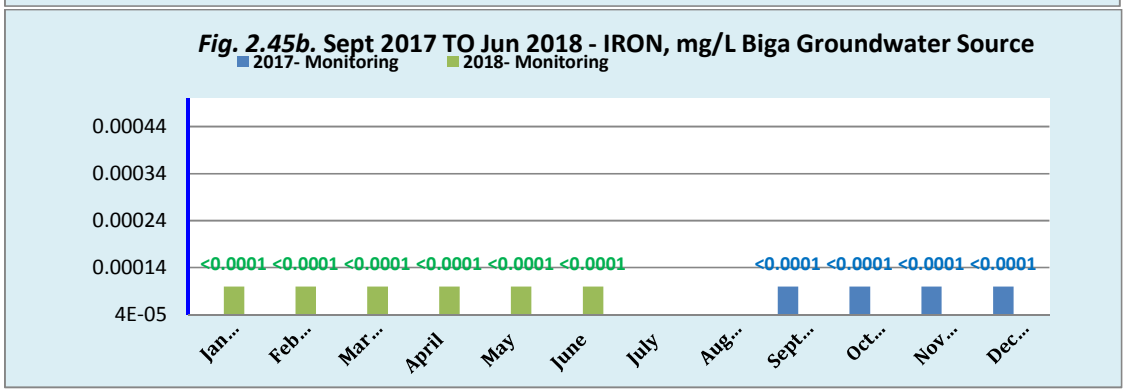
Sampling Station			Analysis/Results										
No.	Station	Elev	pH	TSS	TDS	Ar	Cd	Cr	Cu	Iron	Lead	Mer	Zin
1-GW	Bagacay	192	7.8	2	332	<.01	<0.003	<0.025	<0.02	0.1	0.6	0.002	<0.03
2-GW	Cambangog	70	7.0	<1	480	<.01	<0.003	<0.025	0.02	<0.05	<0.01	0.0005	0.10
3-GW	Cambangog	100	7.6	<1	367	<.01	<0.003	<0.025	<0.02	<0.01	<0.02	<0.0005	<0.03
27-GW	Canlumampao	19	6.8	6	1,200	<0.01	<0.003	<0.025	<0.02	0.4	<0.01	0.001	<0.03
28-GW	Magdugo	38	7	1	1,437	<.01	<0.003	<0.025	<0.07	<0.05	<0.01	0.001	0.8
29-GW	Cabulihan	20	6.8	2	538	<.01	<0.003	<0.025	<0.02	0.4	0.2	<0.0005	0.1
23-GW	AFC, Sangi	55	7.6	1	396	<.01	<0.003	<0.025	<0.02	<0.05	<0.01	<0.0005	<0.03

Highlights of the groundwater test sampling results (CGK-ABS):

a) While As, Cd, Pb and Fe (in decreasing order) have been above the ML in the groundwater sources during the wet season, As and Cd have not been detected in the dry season. Pb, Hg and Fe exceeded the ML during the dry season
b) The pH and TDS values have improved in the dry season relative to the rainy season
c) The groundwater sources at Bagacay (08GW, 19GW and 07GW) have elevated As, Pb and Cd and indicated the highest total heavy metal values during the wet season 2008. The aquifer is fractured, jointed volcanic and meta-sedimentary rock of the Mananga Formation. The hydraulic conductivity K inferred to be generally low, which is estimated to range from 10^{-}□ to 10^{-}□ cm/s
d) The water sources at Cantabaco, Campo 8, Media Once and Poog have elevatd Pb and Cd during the wet season 2008, which have not been detected during the dry season. The aquifer is porous, locally karstic and a more permeable limestone. The hydraulic conductivity K inferred to be generally low, which is estimated to range from 10^{-}□ to 10^{-}□ cm/s
e) The well at the Sapangdaku floodplain (27GW) where tailings from the mine site have been reported by the local residents to have been spilled and deposited during a typhoon some time in the 1970s or 1980s have not indicted highly elevated metal values. Well 27GW has a elevated TDS value of 1,443 mg/L and 1,200mg/L during the wet season 2007 and dry season 2008.

Monitoring for Biga Pit Groundwater was carried from Sept. 2017 to June 2018





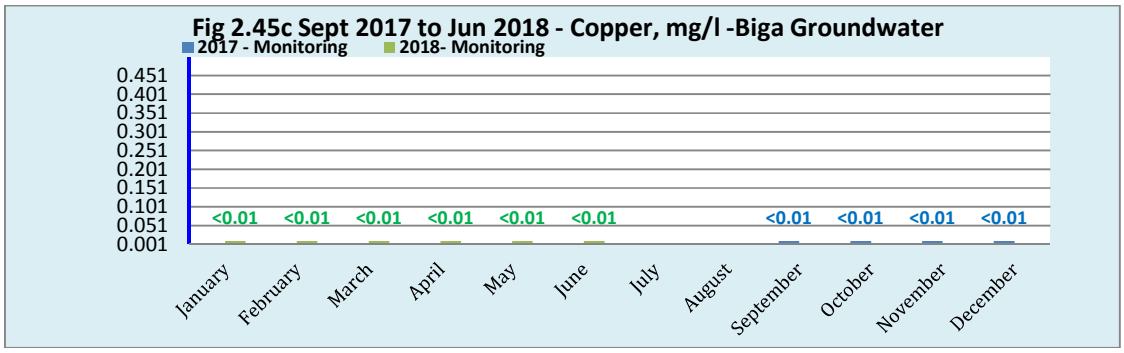


Fig 2.45c Sept 2017 to Jun 2018 - Copper, mg/l -Biga Groundwater
2017 - Monitoring
2018- Monitoring
0.451
0.401
0.351
0.301
0.251
0.201
0.151
0.101
0.051
0.001
<0.01
<0.01
<0.01
<0.01
<0.01
<0.01
<0.01
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<0.01
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January
February
March
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July
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September
October
November
December

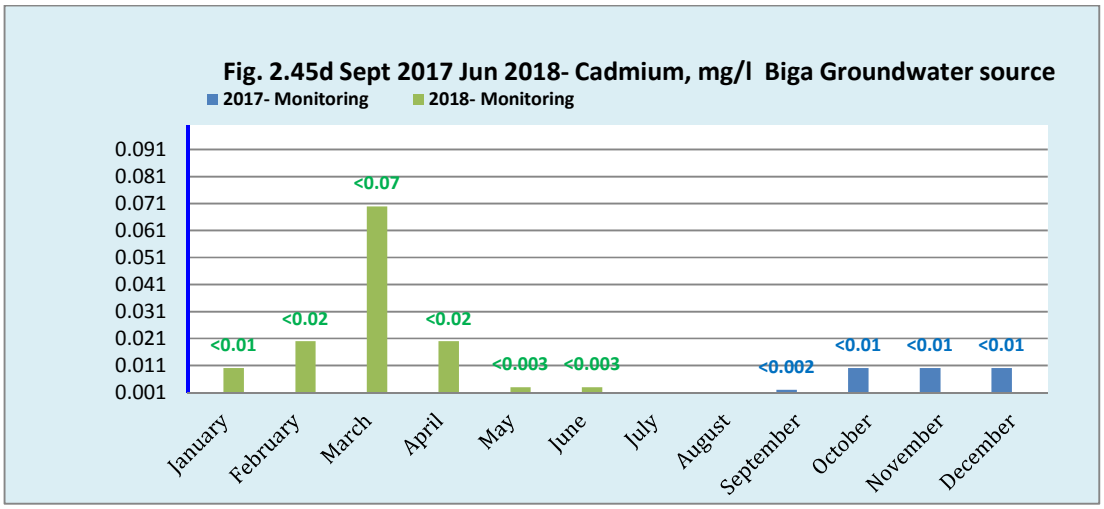
Fig. 2.45d Sept 2017 Jun 2018- Cadmium, mg/l Biga Groundwater source
2017- Monitoring
2018- Monitoring
0.091
0.081
0.071
0.061
0.051
0.041
0.031
0.021
0.011
0.001
<0.01
<0.02
<0.07
<0.02
<0.003
<0.003
<0.002
<0.01
<0.01
<0.01
January
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June
July
August
September
October
November
December

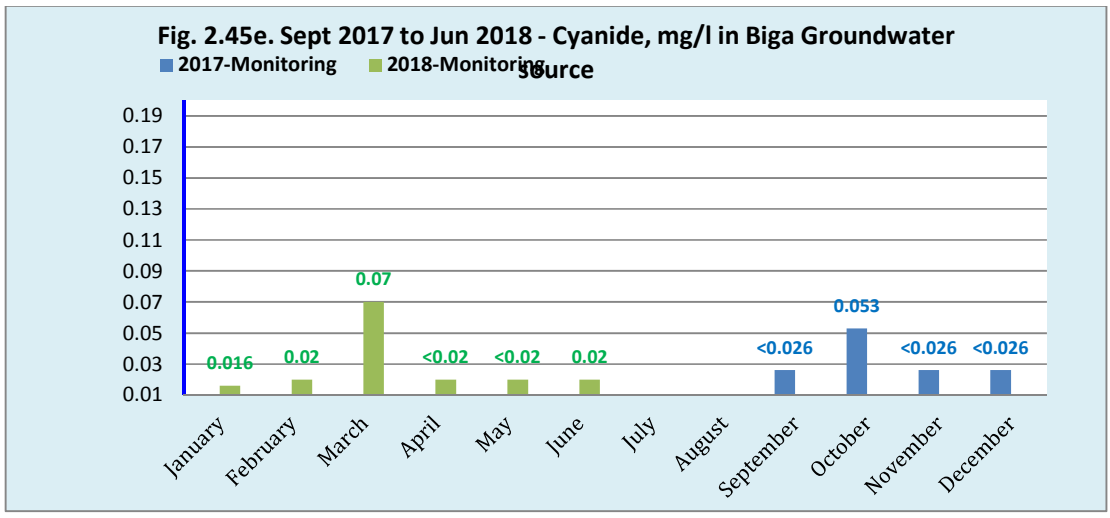
Fig. 2.45e. Sept 2017 to Jun 2018 - Cyanide, mg/l in Biga Groundwater source
2017-Monitoring
2018-Monitoring
0.19
0.17
0.15
0.13
0.11
0.09
0.07
0.05
0.03
0.01
0.016
0.02
0.07
<0.02
<0.02
0.02
<0.026
0.053
<0.026
<0.026
January
February
March
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June
July
August
September
October
November
December

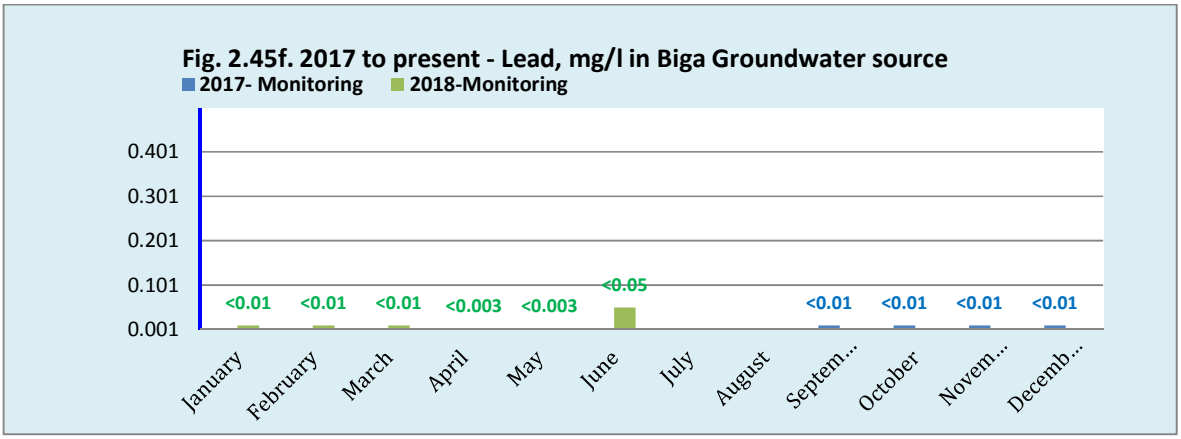
Fig. 2.45f. 2017 to present - Lead, mg/l in Biga Groundwater source
2017- Monitoring
2018-Monitoring
0.401
0.301
0.201
0.101
0.001
<0.01
<0.01
<0.01
<0.003
<0.003
<0.05
<0.01
<0.01
<0.01
<0.01
January
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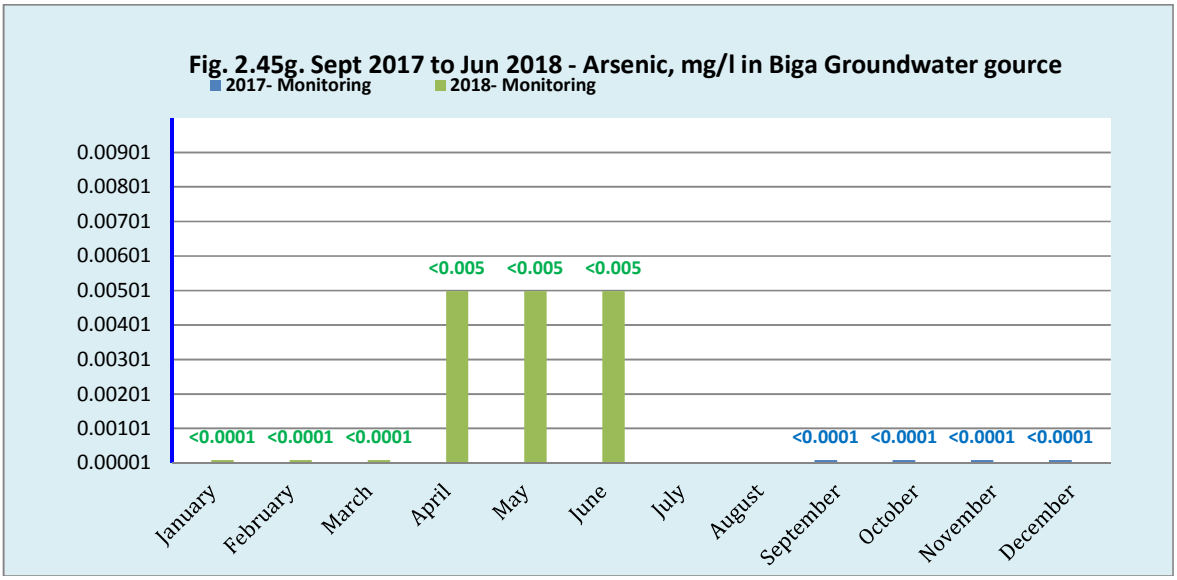
Fig. 2.45g. Sept 2017 to Jun 2018 - Arsenic, mg/l in Biga Groundwater gource
2017- Monitoring
2018- Monitoring
0.00901
0.00801
0.00701
0.00601
0.00501
0.00401
0.00301
0.00201
0.00101
0.00001
<0.0001
<0.0001
<0.0001
<0.005
<0.005
<0.005
<0.0001
<0.0001
<0.0001
<0.0001
January
February
March
April
May
June
July
August
September
October
November
December

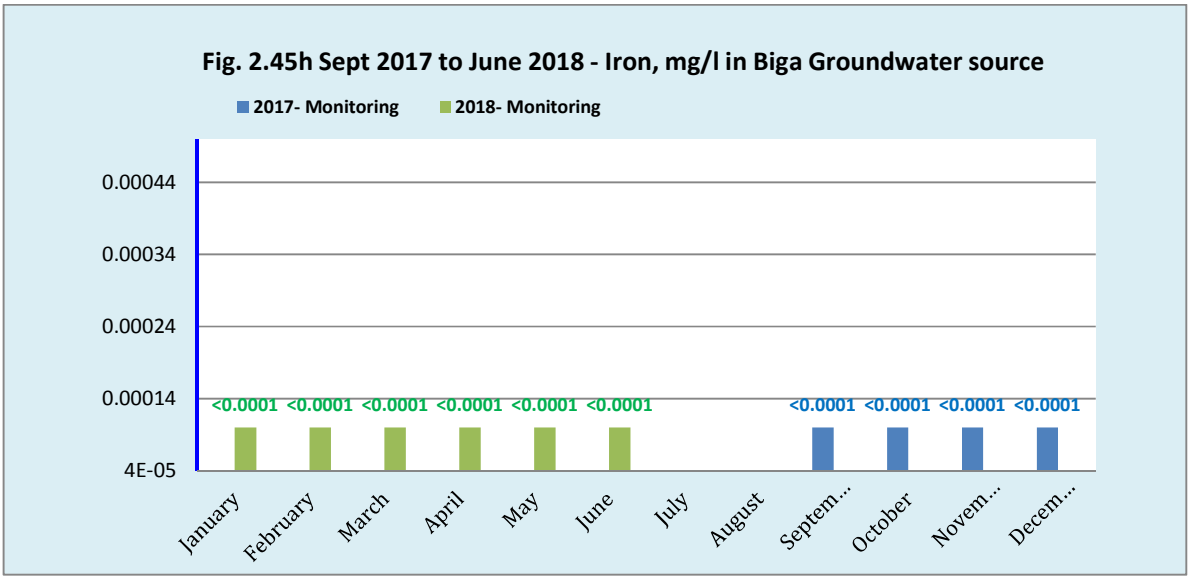
Fig. 2.45h Sept 2017 to June 2018 - Iron, mg/l in Biga Groundwater source
2017- Monitoring
2018- Monitoring
0.00044
0.00034
0.00024
0.00014
4E-05
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
January
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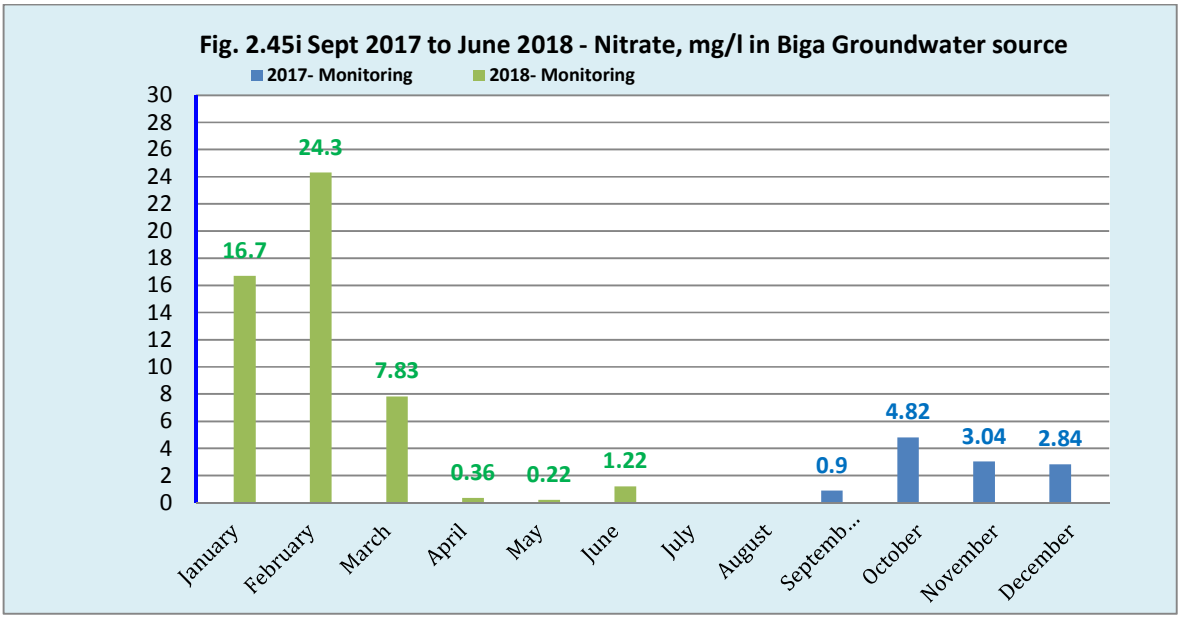
Septem...
October
Novem...
Decem...



2.2.3.2 Degradation of Surface Water Quality

River and Mine Drainage Water Quality

Trace and heavy Metals of Mine Drainage Waters within the Mine Site. *There are five mine drainage waters that have been identified – which flows towards and converges with the receiving waters. The results indicate that the drainage waters from the first three mine drainage waters mentioned below have highly to extremely elevated metal concentrations – and are highly acidic – during both the wet season 2007 and dry season 2008. The oxidation and leaching of the mineralized, sulfide rich and oxidized bedrock and waste dump sites is believed to have led to the highly elevated metal concentrations of the waters. The drainage waters have significantly higher total metal concentrations than the receiving waters.*

The drainage waters (with items 3-5 are within the Airstrip Site Mines TSF project's impact areas) summarized below:

1) *The Biga Pit peripheral drainage waters have relatively high metal concentrations of Cu, Cr and Fe. The highest TDS concentrations (12,084mg/L and 18,012mg/L) and EC values (7.9mS and 9.6mS) come from these drainage waters. Chromium was confined only the Biga Pit drainage waters.*

   The drainage water on the south of Biga Pit (39RW) appears to drain towards Biga Pit and into the SBDT drain tunnel. The drainage water on the southeast of Biga Pit is inferred to drain eventually into Cumba River. The drainage waters have traverse mineralized, sulfide encriched and oxidized outcrops and waste dumps sites.

2) *The SBDT drainage water that comes out of the SBDT portal that is marked 7RW is believed to be partly groundwater flowing along mineralized (sulfide rich) bedrock and possibly the mine tunnels and partly mine surface water from Biga Pit that drains into the SBDT. The leaching of the sulfides is believed to have elevated the metal concentration of the waters.*

The water from the portal indicated very high metal concentrations Cu and Pb and has elevated Fe. The water discharges into Ayunan River, which converges with the Upper Sigpit River at a point that is a few meters upstream of the Sigpit Dam.

The possibility that water seepage from the pond of Carmen Pit contributes to the drainage water coming from the portal of the SBDT is suspected but has not been established.

3) *The drainage located southwest of the airfield marked 26RW which drains the waste dump to the southwest of the airfield and converges with Ilag River.*

Water 26RW has indicated the highest Cu concentration (134mg/L in the wet season 2007 and 174mg/L in the dry season 2008), elevated Pb and relatively very high TDS concentrations.

4) *The drainage located northeast of the airfield drainage where the white colloidal sample that is marked S-IX was taken, which is narrow drainage system flowing on the northeastern side of the airfield and drains towards the Ayunan River.*

5) *The Lutopan Pit drainage water (21RW), which drains towards Ilag River has the lowest total metal concentrations among the drainage waters. The water indicated elevated Cu (3.1mg/L) and Pb (0.2mg/L) in the wet season 2007 only.*

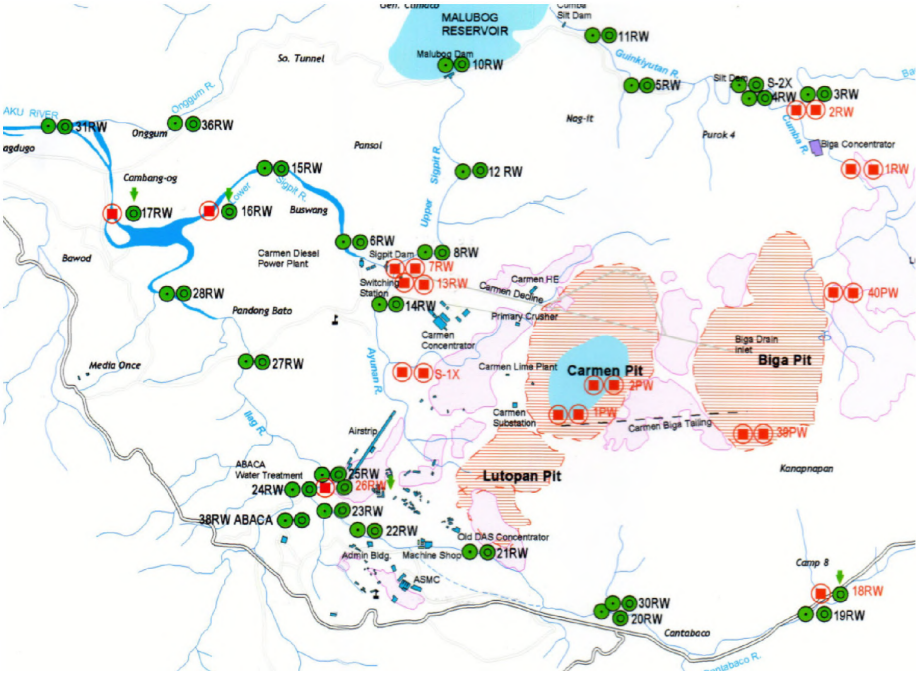


Figure 2.46 **River Water Sampling Stations**

Table 2.32 Metal, Trace Metal and Physico-Chemical Concentrations of River & Drainage Waters, 2007

Sample		Analysis/Laboratory Results												
No.	Station	Elev	pH	TSS	TDS	BOD	Ar	Cd	Cr	Cu	Ir	Lead	Mer	Zin
1RW	Cumba R	271	3.9	10	4323	2	<0.01	<0.02	<0.1	21.4	1.04	0.12	<0.00045	2.36
2RW	Cumba R	214	4.5	25	3672	3	<0.01	<0.02	<0.1	14	2.21	1.54	<0.00045	2.02
4RW	Guinkuyutan R	204	7.2	77	2029	8	<0.01	<0.02	<0.1	4.67	2.99	<0.03	<0.00045	1.06
5RW	Guinkuyutan R	197	7.4	573	6447	5	<0.01	<0.02	<0.1	5.99	15.2	<0.03	<0.00045	0.53

11RW	Guinkuyutan R	190	7.7	106	1601	2	<0.01	<0.005	<0.01	2.99	18.2	<0.05	0.0008	<0.009
10RW	Malubog D	160	8.1	9	352	4	0.03	<0.005	<0.1	0.2	0.6	0.2	0.0007	<0.009
12RW	Upper Sigpit R	10	8.1	106	625	1	<0.01	<0.005	<0.1	<0.04	0.08	<0.02	0.0007	0.1
8RW	Upper Sigpit R	91	7	12	708	5	<0.01	<0.02	<0.1	0.06	0.51	<0.03	0.0008	<0.005
6RW	Lower Sigpit R	59	6.6	91	371	33	<0.01	<0.02	<0.1	1.79	0.43	<0.03	0.002	0.13
15RW	Lower Sigpit R	30	6.6	124	1096	2	<0.01	<0.005	<0.09	2.7	12.2	0.08	0.002	0.2
16RW	Lower Sigpit R	22	5.3	174	1371	2	<0.01	<0.005	<0.09	4.9	19.5	0.3	0.001	0.5
17RW	Sapangdaku	13	5.6	265	1,327	1	<0.01	<0.005	<0.09	4.8	23.1	0.3	0.001	0.5
31RW	Sapangdaku R	13	7.4	396	1,180	1	0.4	<0.005	<0.1	4.4	35.8	<0.03	0.001	0.3
32RW	Sapangdaku R	10	6.9	736	1230	4	0.3	0.02	<0.1	2.7	34.7	<0.03	0.003	0.3
6MW														

Table 2.33 Metal, Trace Metal and Physico-Chemical Concentrations of River & Drainage Waters, 2008

Sample			Analysis/Laboratory Results												
No.	Station	Elev	pH	TSS	TDS	BOD	Ar	Cd	Cr	Cu	Ir	Lead	Mer	Zin	C (mS)
1RW	Cumba R	271	5.1	15	3950	<1	<0.01	<0.003	<0.025	11.3	0.3	<0.01	0.003	0.8	3.6
2RW	Cumba R	214	4.9	16	4095	<1	<0.01	<0.003	<0.025	6.9	1.2	<0.01	0.0005	1	3.6
4RW	Guinkuyutan R	204	6.1	41	3603	2	<0.01	<0.003	<0.025	4.8	1.1	<0.01	<0.0005	1	3.2
5RW	Guinkuyutan R	197	7.3	43	3088	<1	<0.01	<0.003	<0.025	3.4	10.4	<0.01	<0.0005	0.7	2.9
11RW	Guinkuyutan R	190	7.6	36	2923	<1	<0.01	<0.003	<0.025	0.4	0.07	<0.01	<0.0005	0.4	2.80
10RW	Malubog D	160	8.4	4	877	2	0.03	<0.003	<0.025	0.04	0.05	<0.01	<0.0005	<0.03	0.001
12RW	Upper Sigpit R	10	7.8	2	919	4	<0.01	<0.003	<0.025	0.02	<0.05	<0.01	0.0005	<0.03	1.17
8RW	Upper Sigpit R	91	8.1	5	962	6	<0.01	<0.003	<0.025	0.09	0.07	<0.01	0.0009	0.04	0.001
6RW	Lower Sigpit R	59	7.2	70	1303	<1	<0.01	<0.003	<0.025	2.6	1.6	<0.01	0.0005	0.3	1.6
15RW	Lower Sigpit R	30	7.3	106	1365	1	<0.01	<0.003	<0.025	2.6	2	<0.01	<0.0005	0.3	1.48
16RW	Lower Sigpit R	22	7.5	115	1447	7	<0.01	<0.003	<0.025	2.4	2	<0.01	<0.0005	0.3	1.63
17 RW	Sapangdaku	13	7.9	70	1,888	1	<0.01	<0.003	<0.025	1.7	1.5	<0.01	<0.0005	0.2	0.21
31 RW	Sapangdaku	13	7.6	220	1,907	1	<0.01	<0.003	<0.025	1.8	4.6	<0.01	<0.0005	0.2	0.20
32RW	Sapangdaku R	10	7.7	186	1696	3	<0.01	<0.003	<0.025	0.4	3.2	<0.01	<0.0005	0.05	0.19

Heavy Metals in the Receiving Waters. *The Atlas Mine and the surrounding area is drained by two main river segments that converge with the Sapangdaku River. Considered as receiving waters, these are a) the Bagacay-Guinkuiyutan-Malubog-Sigpit River segment on the north or the northern river segment, and b) the Cantabaco-Ilag River Segment on the south or the southern river segment. The two river segments converge into the Sapangdaky River. The northern river segment has higher total trace and heavy metal concentrations compared to the southern river segment during both seasons. Two theories are presented. First, the waters of the southern river segment flows largely over the limestone rockmass of the Cebu formation, which is likely serving as a natural buffer against the reduction of the pH levels of the surface waters, which is in turn associated with a reduced heavy metal concentration. Second, the northern river segment is the recipient of waters that flows across a larger body of mineralized waste dumps and receives the waters from Cumba River and the drainage waters from the mine, including the water flowing from the portal of the SBDT.*

Acid Mine Drainage. *The results and findings and the surface manifestations on site as explained (Atlas Baseline Study), indicated that acid mine drainage (AMD) occurs in the peripheral drainage waters of Biga Pit, in the upper Cumba River, the lower Ayunan Creek and the middle section of the upper Ilag river.*

The FMRDP (2010), identified the following sources of Atlas AMD:

- *Carmen and Biga Pits, which drainage outflow discharges to the Sigpit Drain Tunnel and thence to the Sigpit Creek*
- *Old waste dumps around Lutopan and Lantoy catchments that drain to the Ilag River;*
- *Underground mine water outflow at Ilag River;*
- *Waste dumps west of Carmen Pit draining to the Sigpit-Hinulawan River, and*
- *Waste dumps north and east of the Biga Pit draining to the Malubog Reservoir.*

The highly elevated metal concentrations detected during the 2007-2008 baseline study could be attributed to the following:

- The decreasing impounding capacity of Biga Pit affects the settling process.
- Erosion of mineralized waste rock into surface drainages leads to high concentrations of metals in stream sediments.
- Due to ore extraction the soil structure was disturbed and exposed to weathering and oxidation.

The mitigation measures being implemented to address the above concerns-particularly to reduce higher levels of metal concentrations on drainage/surface waters are as follows:

- The Biga Pit was converted to a storage facility, despite the mineable tonnage of ore reserved the company forgo to address the possible environmental impact.
- Established and regularly maintained the peripheral drainage of the pits.
- Settling ponds were constructed maintained regularly to ensure water discharge pass DENR standards.
- Conducted lime application to neutralize the acidity of discharge water.
- Implement water recycling system at Carcon Facility established Tailings Thickeners, Reclaimed Pump House and Head tank for the storage of reclaimed water.
- Implement the Zero Discharge Scheme in BTSF.

The Biga Pit Effluent monitoring from September 2016 to June 2018 indicated high and low levels of certain parameters on various periods which :

- Sampling for Nitrates on 2018 indicated higher levels during Jan-Feb, but low from Mar-Dec.The total amount of precipitation in January and February is 7,841 ml and 4,643 ml, respectively. The bulk of the days have been rainy for the past two months; potential causes include runoff from fertilized farms and animal waste from North Biga.
- Higher levels of TSS in June (2017) but very low on other months. High also in May & June (2018) but low in other months; which is being attributed to the following: a) this month is a rainy season and during our sampling activity the weather is rainy. Runoff flows towards the established peripheral drainage and impound at Biga Pit; b) ongoing dumping activity of mine waste at West Biga. As a result, the high TSS is caused by runoffs that are easily associated with this backfill and loose earth elements.
- High levels of Cu in Feb, but low on other months (2018) , which was attributed ot mine waste being dumped continuously at West Biga. The mine waste still contains minerals, particularly low grade copper.
- Higher levels of Zinc in January (2017), moderately high in April (2018), as compared to other months. Zinc is a naturally occurring heavy metal that is abundant in the earth crust. At West Biga, mine waste has been dumped continuously. It's probable that during this month, the zinc concentration in mine waste is high; the zinc then joins the runoff and flows toward the Biga Effluent

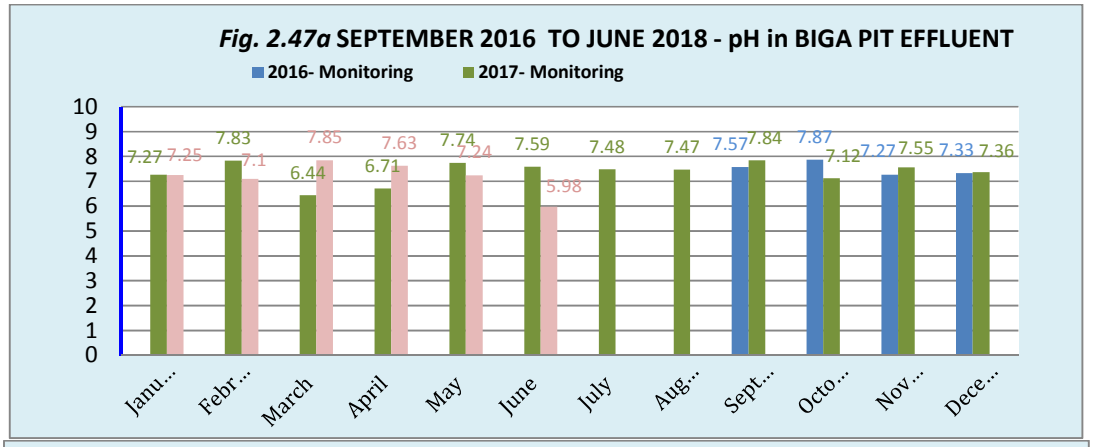


Fig. 2.47a SEPTEMBER 2016 TO JUNE 2018 - pH in BIGA PIT EFFLUENT
2016- Monitoring
2017- Monitoring
10
9
8
7
6
5
4
3
2
1
0
7.27 7.25
7.83 7.1
6.44 7.85
6.71 7.63
7.74 7.24
7.59 5.98
7.48
7.47
7.57 7.84
7.87 7.12
7.27 7.55
7.33 7.36
Janu...
Febr...
March
April
May
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Octo...
Nov...
Dece...

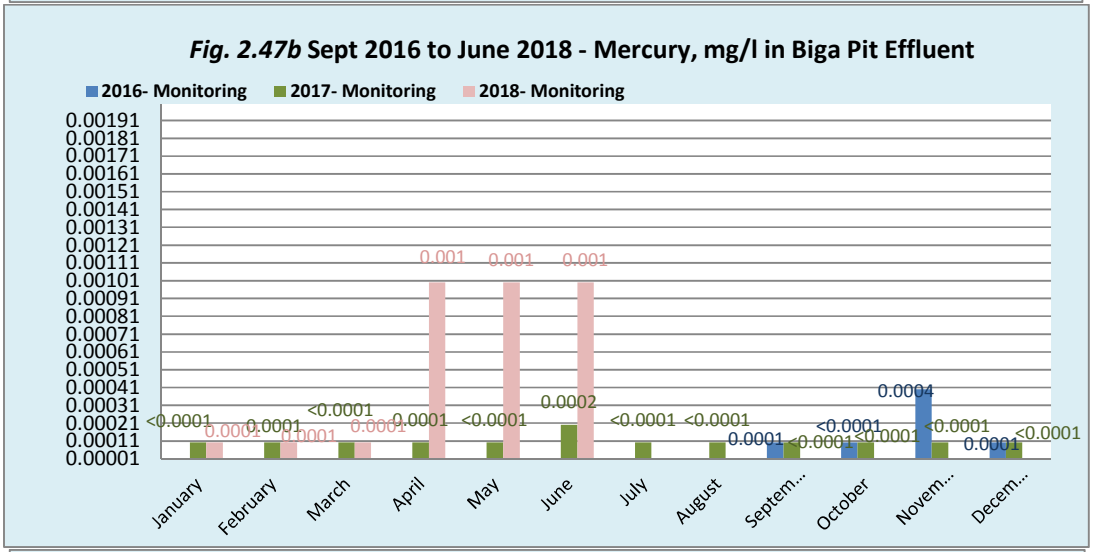
Fig. 2.47b Sept 2016 to June 2018 - Mercury, mg/l in Biga Pit Effluent
2016- Monitoring
2017- Monitoring
2018- Monitoring
0.00191
0.00181
0.00171
0.00161
0.00151
0.00141
0.00131
0.00121
0.00111
0.00101
0.00091
0.00081
0.00071
0.00061
0.00051
0.00041
0.00031
0.00021
0.00011
0.00001
<0.0001
<0.0001
0.0001
<0.0001
0.0001
0.001
<0.0001
0.001
0.0002
0.001
<0.0001
<0.0001
0.0001
<0.0001
<0.0001
0.0004
<0.0001
0.0001
<0.0001
January
February
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June
July
August
Septem...
October
Novem...
Decem...

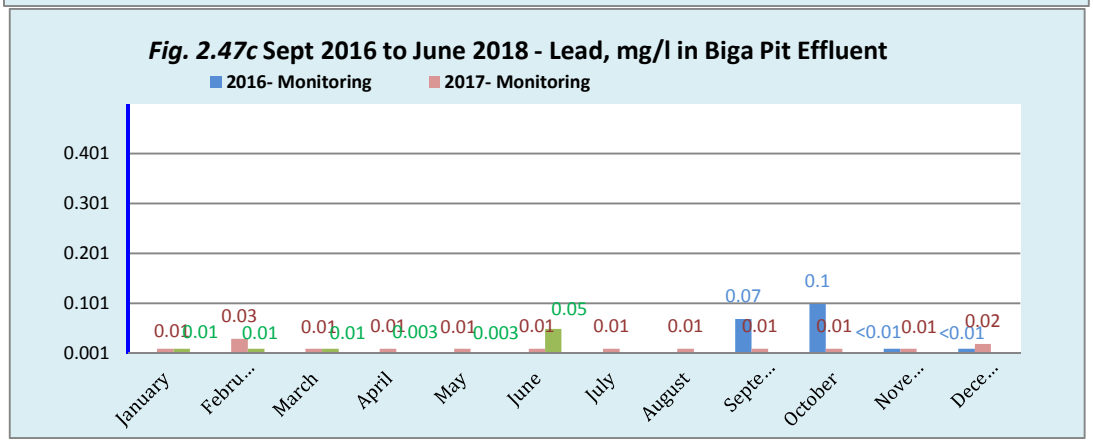
Fig. 2.47c Sept 2016 to June 2018 - Lead, mg/l in Biga Pit Effluent
2016- Monitoring
2017- Monitoring
0.401
0.301
0.201
0.101
0.001
0.01 0.01
0.03 0.01
0.01 0.01
0.01 0.003
0.01 0.003
0.01 0.05
0.01
0.01
0.07 0.01
0.1 0.01
<0.01 0.01
<0.01 0.02
January
Febru...
March
April
May
June
July
August
Septe...
October
Nove...
Dece...

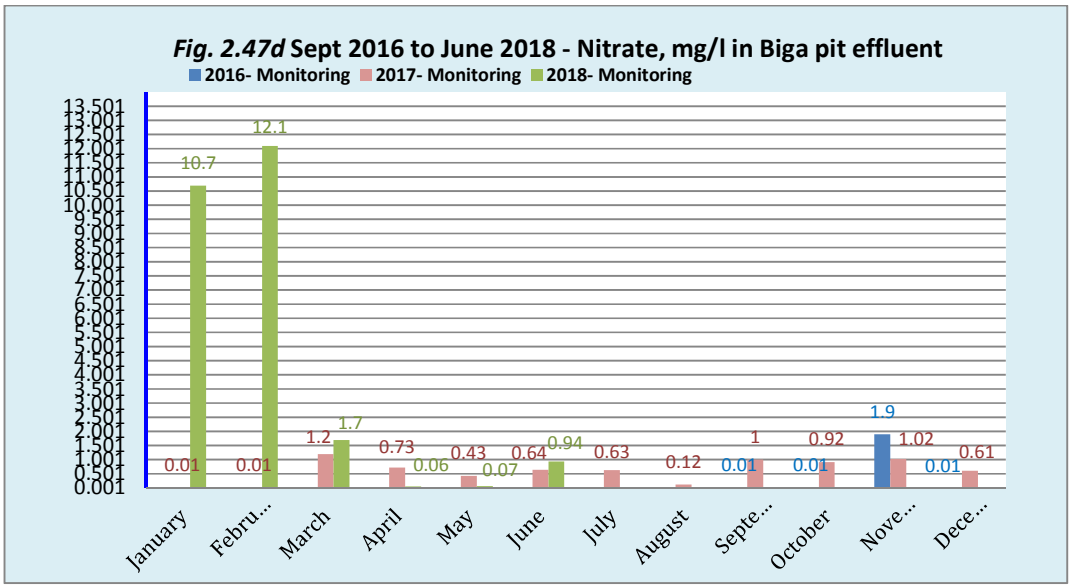
Fig. 2.47d Sept 2016 to June 2018 - Nitrate, mg/l in Biga pit effluent
2016- Monitoring
2017- Monitoring
2018- Monitoring
January
Febru...
March
April
May
June
July
August
Septe...
October
Nove...
Dece...

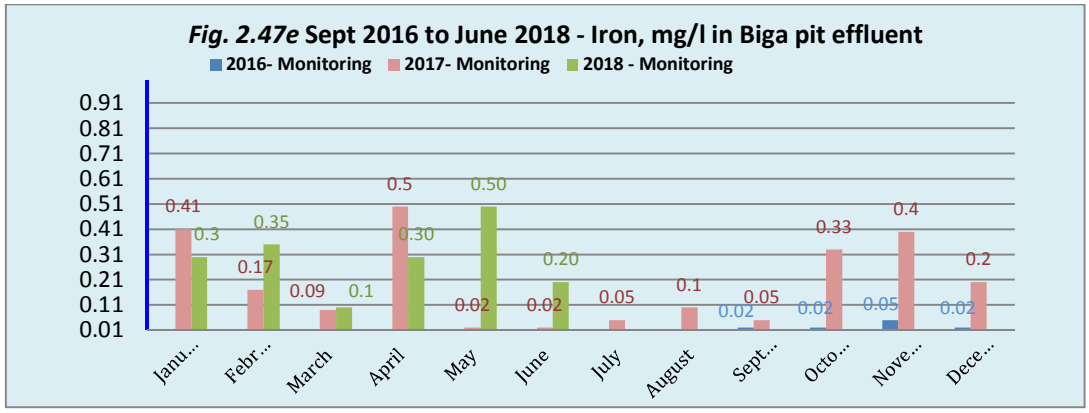
Fig. 2.47e Sept 2016 to June 2018 - Iron, mg/l in Biga pit effluent
2016- Monitoring
2017- Monitoring
2018 - Monitoring
Janu...
Febr...
March
April
May
June
July
August
Sept...
Octo...
Nove...
Dece...

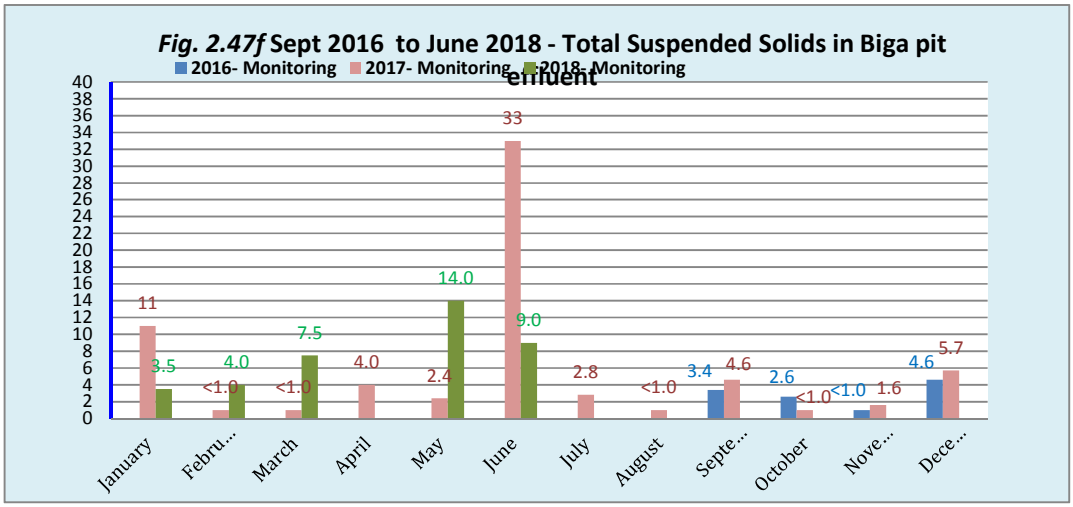
Fig. 2.47f Sept 2016 to June 2018 - Total Suspended Solids in Biga pit effluent
2016- Monitoring
2017- Monitoring
2018- Monitoring
January
Febru...
March
April
May
June
July
August
Septe...
October
Nove...
Dece...

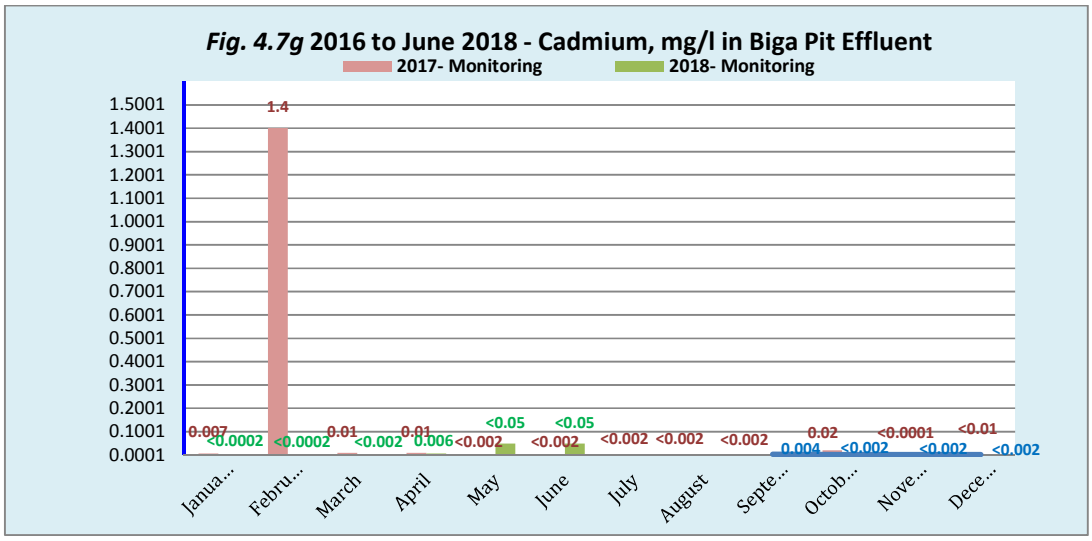
Fig. 4.7g 2016 to June 2018 - Cadmium, mg/l in Biga Pit Effluent
2017- Monitoring
2018- Monitoring
1.5001
1.4001
1.3001
1.2001
1.1001
1.0001
0.9001
0.8001
0.7001
0.6001
0.5001
0.4001
0.3001
0.2001
0.1001
0.0001
0.007
<0.0002
1.4
<0.0002
0.01
<0.002
0.01
0.006
<0.002
<0.05
<0.002
<0.05
<0.002
<0.002
<0.002
0.02
0.004
<0.0001
<0.002
<0.01
<0.002
Janua...
Febru...
March
April
May
June
July
August
Septe...
Octob...
Nove...
Dece...

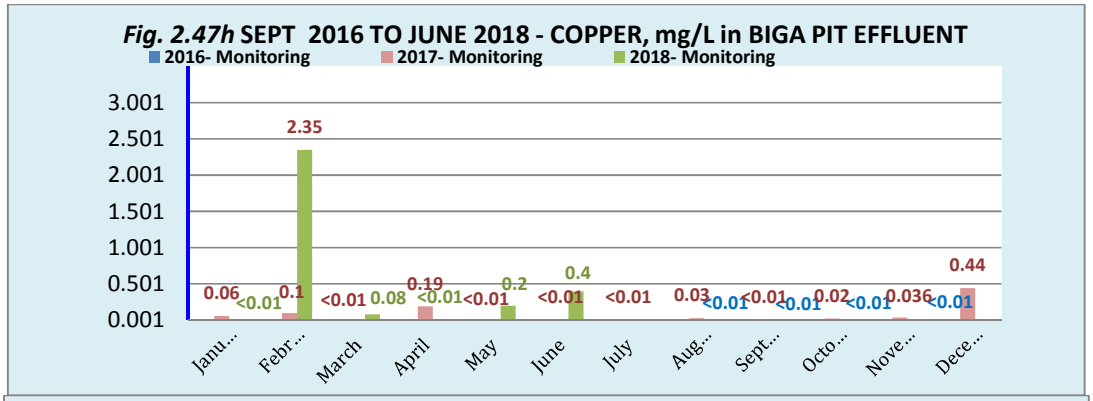
Fig. 2.47h SEPT 2016 TO JUNE 2018 - COPPER, mg/L in BIGA PIT EFFLUENT
2016- Monitoring
2017- Monitoring
2018- Monitoring
3.001
2.501
2.001
1.501
1.001
0.501
0.001
0.06
<0.01
0.1
2.35
<0.01
0.08
0.19
<0.01
<0.01
0.2
<0.01
0.4
<0.01
0.03
<0.01
<0.01
<0.01
0.02
<0.01
0.036
<0.01
0.44
Janu...
Febr...
March
April
May
June
July
Aug...
Sept...
Octo...
Nove...
Dece...

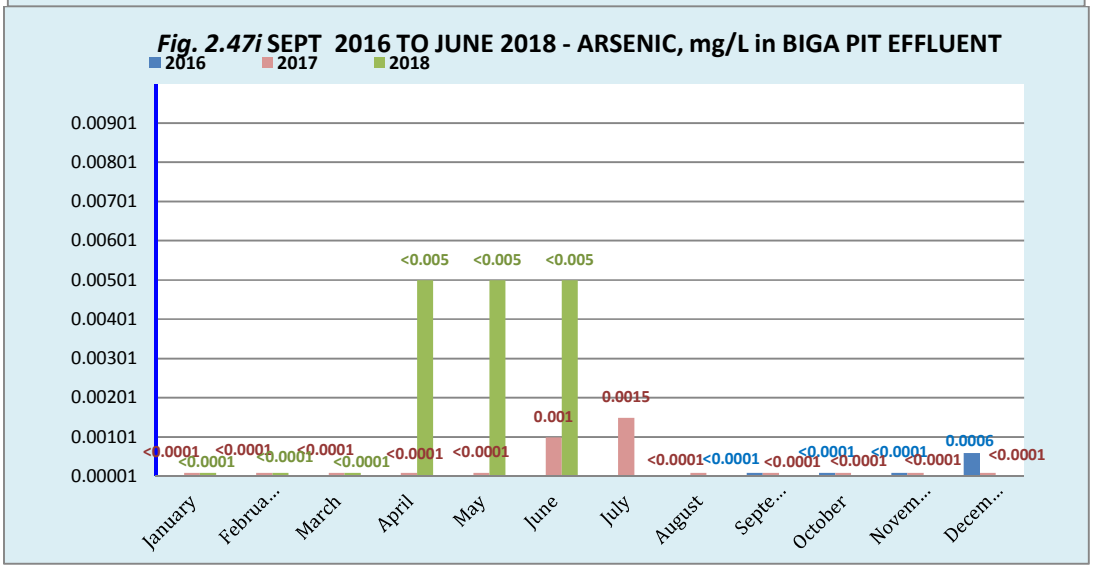
Fig. 2.47i SEPT 2016 TO JUNE 2018 - ARSENIC, mg/L in BIGA PIT EFFLUENT
2016
2017
2018
0.00901
0.00801
0.00701
0.00601
0.00501
0.00401
0.00301
0.00201
0.00101
0.00001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.005
<0.0001
<0.005
<0.0001
<0.005
0.001
0.0015
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
<0.0001
0.0006
<0.0001
January
Februa...
March
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May
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July
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October
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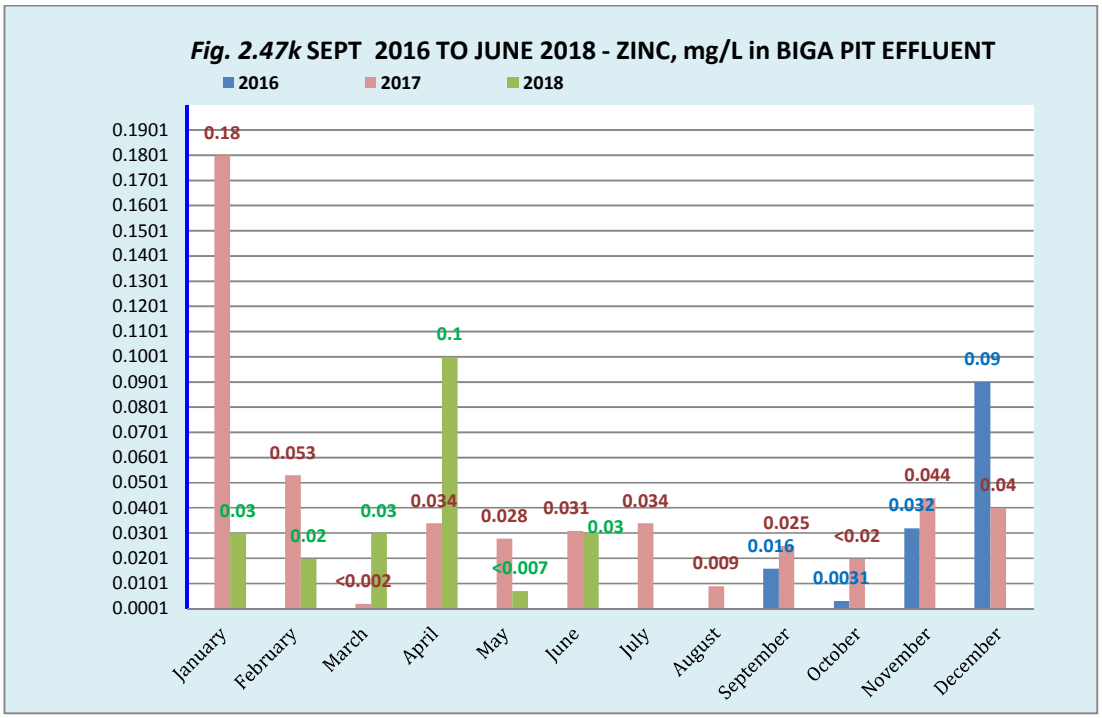
Decem...



2.2.4 Marine Ecology

The Department of Environment and Natural Resources (DENR) through the Tañon Strait Protected Seascape - Protected Area Management Office of Badian, Cebu conduced a biophysical assessment of the coastal and marine resources in Toledo City, last October 18-29 2021. This assessment focuses on the quantitative data on the status of coral reefs, fish populations, macro-invertebrate community, seagrass beds, and mangrove cover. The study covers the ten (10) barangays of Toledo City, including Barangay Daanglungsod where the Atlas Port/Pier is located. Daanglungsod is bound on the North by Brgy Dumlog, while on the South is Brgy Poblacion. The following are the salient findings of the assessment.

- NAMRIA reported 1.60 ha. of mangrove cover in Toledo City but after ground validation it was establish that no mangrove stands were found within the TSPS jurisdiction
-
- Eight (8) seagrasses species were found in the ten (10) coastal barangays with the highest mean cover observed in Barangay Ibo with 66.11±20.58%. Halodule pinifolia was the most dominant species with 14.86% cover

- Coral reef status was categorized under “HCC CD” reef condition (previously identified as “Poor” condition) having only 20.85±3.78% mean coral cover, followed by Dead Coral with Algae (DCA) at (46.77±4.19%). Diversity index fell under Category A in the Taxonomic Amalgamation Unit (TAUs) With 38 genera recorded.

- A total of 118 reef fish species distributed across 66 genera from 26 families were identified and recorded. Mean fish density is in “poor” condition with 310.83±37.71 individuals/1000m². In terms of abundance by family, Damselfish (Pomacentridae)

dominate the area with a mean count of 189.92±14.56 individuals/1000m². Mean fish biomass is in "Medium" condition with only 11.43±4.07 Mt/km². Herbivore were the most abundant trophic group with an average of 103.08±131.44 individuals/1000m².

- A total of 33 species of Macroinvertebrates representing 33 genera from 7 families were identified and recorded. Mollusca is the most diverse phyla with 6 species recorded. Highest mean population density was observed with Phylum Mollusca with 21.62±8.41 individual/250m2

Figure __ showed the location of Surveyed areas and its comparison between NAMRIA and DENR actual survey data. Figures _ exhibited the graphical results of the Survey, most of the graphs did not included Daanlungsod where the Atlas Port is located, but its neighboring Brgy. Poblacion is shown in all graphs.

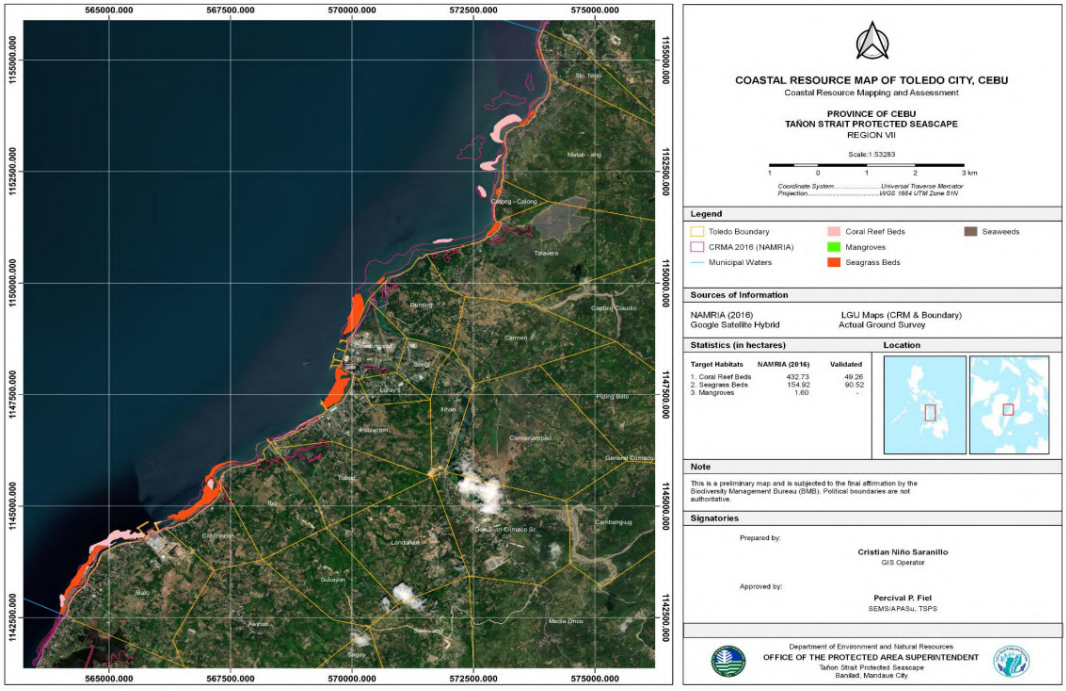


Figure 2.48 Map showing the location surveyed areas and its comparison between NAMRIA data and DENR actual survey of coral reef, seagrass beds and mangrove forest.
Source: DENR-TSPAMO. 2021. Toledo City, Cebu Biophysical Assessment

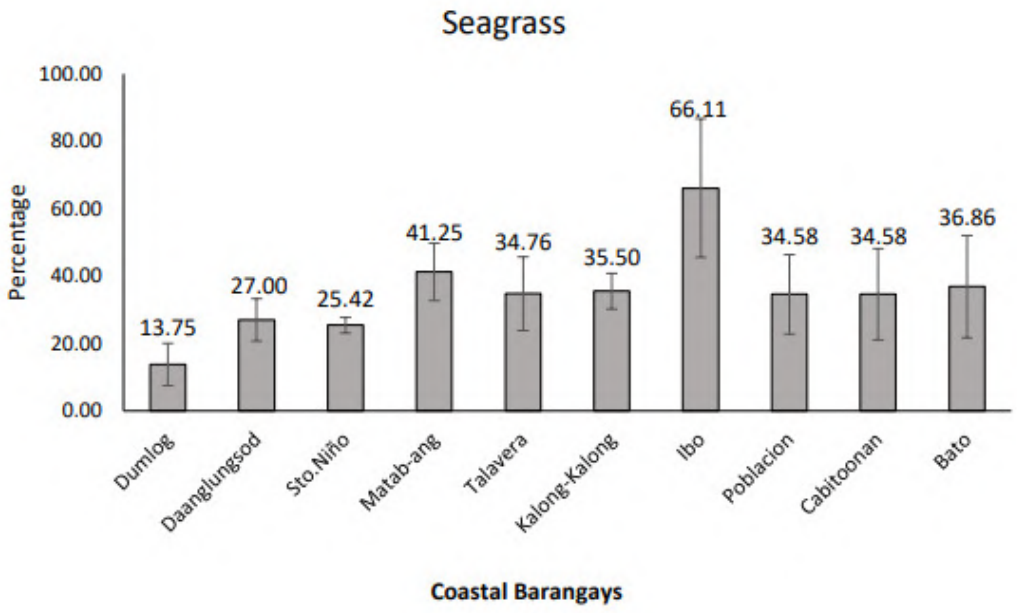


Figure 2.49a Mean Percent Cover of Seagrasses in Toledo City
Source: DENR-TSPAMO. 2021. Toledo City, Cebu Biophysical Assessment

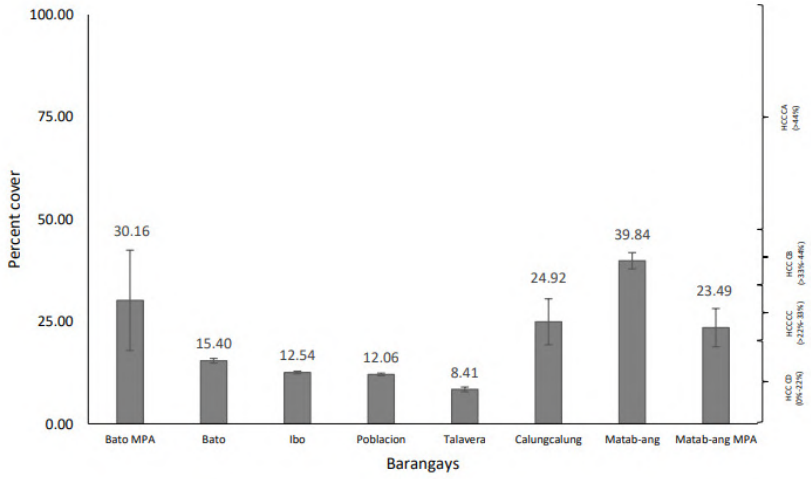


Figure 2.49b Mean Percent Cover of Coral Cover in Toledo City
Source: DENR-TSPAMO. 2021. Toledo City, Cebu Biophysical Assessment

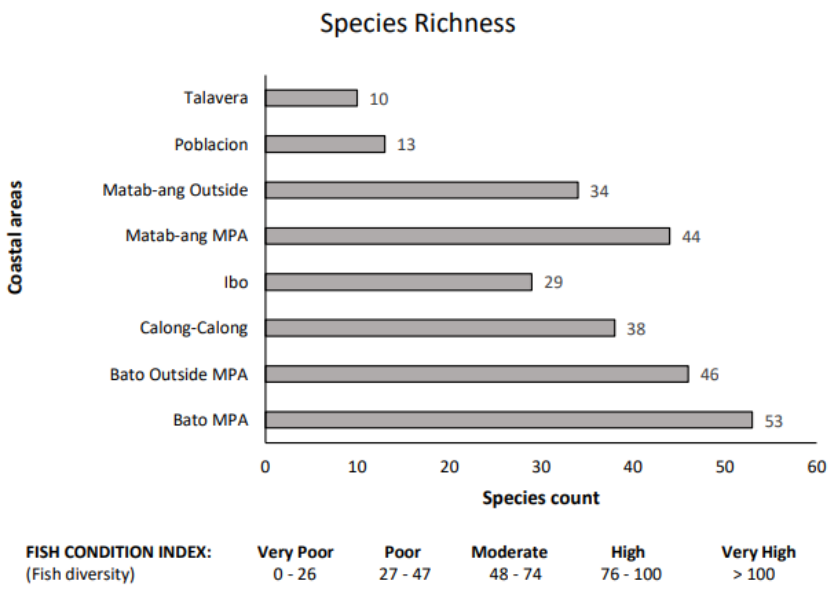


Figure 2.49c. Fish species richness within the surveyed areas of Toledo City, Cebu.
Source: DENR-TSPAMO. 2021. Toledo City, Cebu Biophysical Assessment

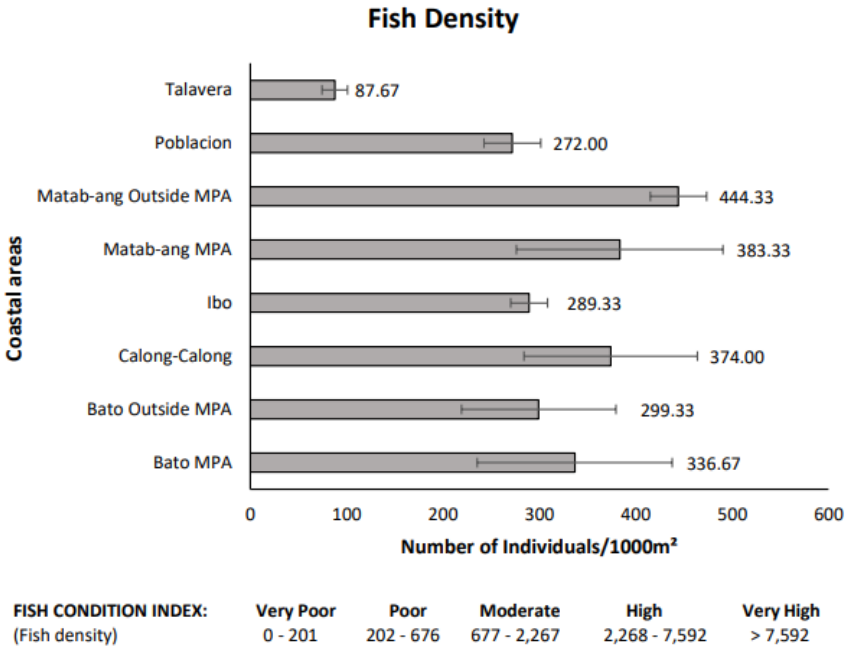


Figure 2.49d. Mean (SE±) population density of fishes recorded within the surveyed areas of Toledo City, Cebu.
Source: DENR-TSPAMO. 2021. Toledo City, Cebu Biophysical Assessment

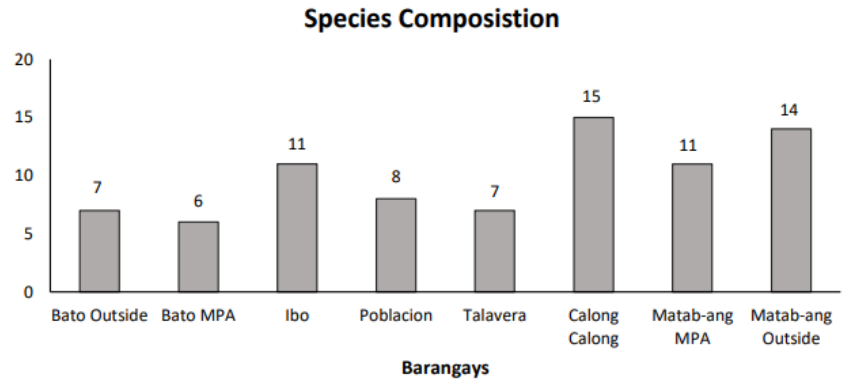


Figure 2.49e. Species richness of Macro invertebrates found in the surveyed areas in Toledo City, Cebu, Philippines (Source: DENR-TSPAMO. 2021. Toledo City, Cebu Biophysical Assessment)

Degradation of coastal/marine water quality

The CGK-ABS (2008) noted the following results/analysis from the marine environment baseline study:

a) Marine Water

- The heavy metal concentrations have generally declined from the immediate receiving waters of ATLAS mine downstream towards the coastline.
- Marine water samples collected in 2007 & 2008 generally did not exceed the limit set by DENR for Class SA and SB coastal and marine waters.. [t]his implied that there was no significant amount of metal contaminants in the tributaries or rivers which discharged to the sea
- Metal concentrations were not detected in the waters at the marine outfall of the mine tailings at Ibo, Toledo City
- The results showed that most of the metals were immobilized or adsorbed on the sediment..the dissolved metals may have also been converted to non-soluble forms once they entered the sea

b) ***Marine Sediments.*** The results showed that most of the metals were immobilized or adsorbed on the sediment as indicated in the higher concentration found in the sediment than in the water column. The pH of the sea water observed in the wet season and dry season was slightly basic (7-8 to 8.2). This pH range does not favor dissolution of metals in water. The slightly basic pH might have also converted soluble metal to non-soluble forms.

c) ***Fish.*** The metal concentrations present in the fish and mollusk samples were generally low. It was only Fe Zn that showed relative high concentrations. The concentrations present were however still within the safe levels set for human consumption. These metals are essential for human health.

d) ***Mollusk Samples***. Among the eight metals determined in the mollusks, Cu and Zn concentrations were relatively high. These tow metals were also high in the sediment samples. Mollusks and bivalves are bottom feeders and could bioaccumulate the metals they take in from the environment where they were found.

2.2.5 Freshwater Ecology

River Water Ecology. *Mudfish and catfish are the most common economically important fishes recorded in the systems of the mine. In some stations, fishes observed were economically unimportant*

(i.e. guppy). Dams and the effects of sand quarrying (i.e., stockpile of sand and very deep pools) were the more obvious barriers to fish movement.

Aquatic vegetation is commonly found. However algae in the form of slime, clumps or filaments, are rare. The absence of algae could mean low amount of nutrients such as nitrates and phosphates in water. In areas where sand quarrying is being done, pool areas could increase while riffle areas could decrease. A change in type of habitat, would lead to a change in the biological community structure of the river.

Overall, the fish and crustacean fauna of the Sapangdaku River system are severely depleted, and this influence extends upstream of the mine area. However, this is due to inhibition of recruitment of marine life stages, and the pattern of distribution is consistent with the source of this inhibition being the Atlas mine site. The most severely depleted streams are those directly draining the mine areas, particularly, waste rock dump deposits and mine pits. There is some amelioration of the impacts to fishes and crustaceans downstream of the Malubog reservoir, but this is reversed downstream of the Sigpit Creek.

Table 2.34 Macroinvertebrate Families Observed

	Wet Season Oct 2007			Dry Season Apr 2008				Wet Season Oct 2007			Dry Season Apr 2008		
	S1	S2	S8	S1	S2	S8		S1	S2	S8	S1	S2	S8
Ephemeroptera							Odonata						
Ephemerellidae							Libelluidae	+			+	+	
Leptophlebidae	+			+	+	+	Cordulidae						
Baetidae	+		+	+	+	+	Hemiptera						
Heptageniidae		+					Vellidae				+		
Tricorythidae				+			Gerridae						
Caenidae				+		+	Naucoridae						
Trichoptera							Diptera						
Philopotamidae				+		+	Tabanidae						
Hydropsychidae	+	+	+	+		+	Tipulidae						
Hydroptilidae	+			+			Chironomidae	+	+	+	+		+
Limnephilidae		+					Strationmyidae						
Coleoptera							Psychodidae						
Gyrinidae							Caenogastropoda						
Elmidae	+			+		+	Thiaridae	+	+		+	+	
Hydrophilidae				+			Pleuroceridae	+					
Dysticidae	+						Basommatophora						
Psephenidae							Physidae						
Dryopidae							Decapoda						
Lepidoptera							Atyidae						
Pyralidae						+	Palaemonidae						
							Taxa richness	**10**	**5**	**3**	**13**	**6**	**8**

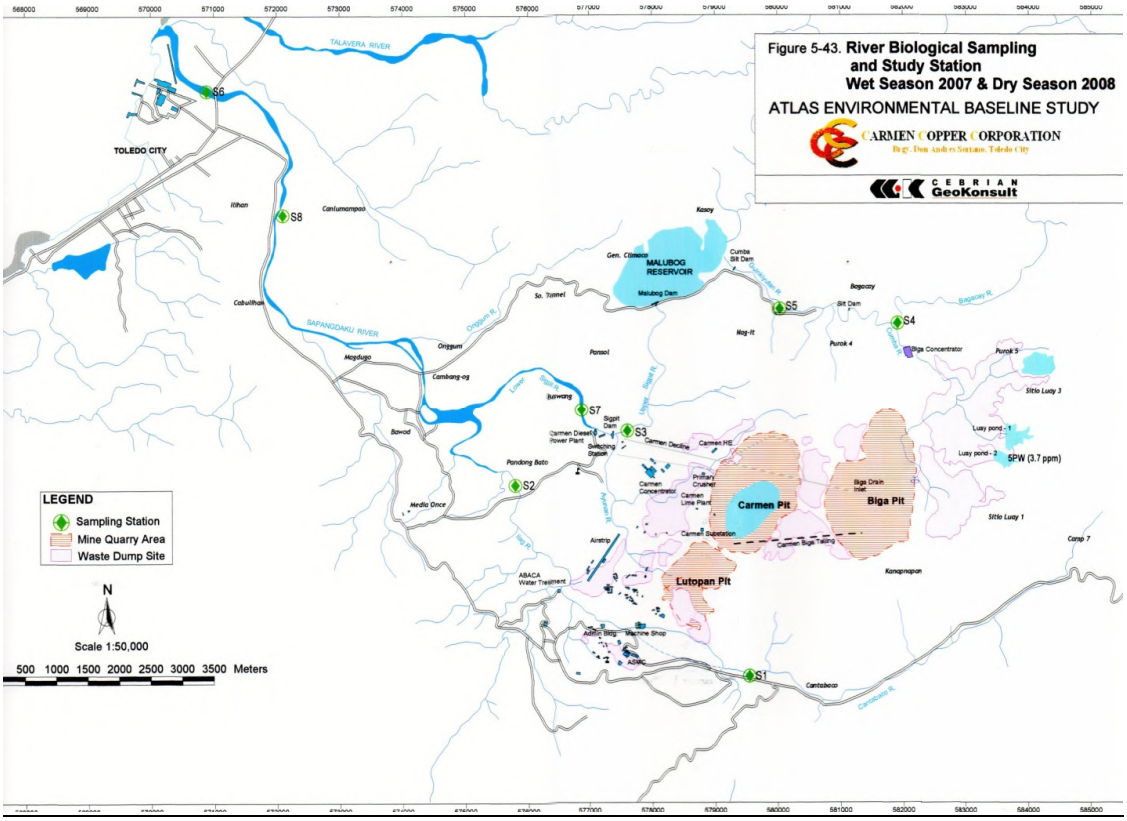


Figure 2.50 **Riverwater Ecological Map**

Table 2.35 **Selected Physicochemical Parameters**

	Elev	Temp (°C)	pH	BOD (mg/L)	TSS (mg/L)	TDS (mg/L)	FR m/s	Depth m	Width m	Dschrg m^3/s
Wet										
S1	276	24.2	7.3	2	12	2906	0.42	0.39	6.5	0.836
S2	121	27.5	7.2	1	97	1085	0.35	0.10	8.5	0.229
S8	13	32.0	6.9	4	736	1230	0.30	0.39	20.0	2.593
Dry										
S1	276	27.0	8	8	<1	557	0.55	0.20	5.5	0.486
S2	121	28.0	7.6	<1	144	1085	0.70	0.16	12.5	1.098
S8	13	28.0	7.7	3	50	1733	0.44	0.24	22.5	1.891

Table 2.36 Water Quality Standard (WQS) for Fresh Waters

Parameter	Water Body Classification				
	AA	A	B	C	D
Temp (d) (°C rise)		3			
pH (range)	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.0-9.0
BOD, (mg/L)	1	5	5	7(10)	10(15)
TSS (mg/L)	25	50	(f)	(g)	(h)
TDS (mg/L)	500 (i)	1000 (i)	--	--	1000 (i)

(d) = allowable emp. Increase over the average ambient temp. for each month
(f) = not more than 30% increase
(g) = not more than 30 mg/L increase
(h) = not more than 60 mg/L increase
(i) = not applicable if natural background is higher in concentration
(j) = applicable only to lakes, reservoirs, and similarly impounded water
NR = no recommendations made

Biga TSF Surrounding/Impact Areas (River/Creeks) Water Sampling/Analysis

Aside from the CGK Baseline Study conducted in 2007-2008, a number of water sampling/analysis were undertaken in Biga Pit, such as the following: a) CCC self-monitoring sampling (regularly done), b) MMT monitoring activities (quarterly), and c) GHD study (2011).

The GHD study's sampling and analysis for Biga Pit and surrounding surface waters noted the following "Parameters of Concern":

> *Of the parameters tested in water samples from the Biga Pit, the identified parameters exceeding current guidelines are phosphates and nitrates.*
>
> *Hexavalent chromium showed some elevated results but still within guidelines. This metal is toxic and can have a significant detrimental effect on human, animal, and plant health. Concentrations therefore need to be tracked, to confirm levels stay below guidelines.*
>
> *Concentrations of phosphates were found to exceed the DAO 90–34 guideline across all Biga Pit samples except BG 1.1 and BG 2.1, both surface samples. It is uncertain as to the source of the increased Phosphate levels, but it is believed that mining operations are unlikely to be the source.*
>
> *Additional testing of samples taken from the mill process system will be required to determine whether the source of Phosphates is within the mining process or from the external environment. Nitrates also exhibited several spikes in the Biga Pit water samples, though concentrations were quite variable across the stations. These may be anomalous, and further testing is required to verify the potential sources of Nitrates within the pit. It should be noted though that the receiving water bodies themselves have significant amounts of nitrates, as well, especially in the Sapangdaku and Sigpit Rivers*

However, the same GHD study also indicated that the "recent round of testing has shown the water quality in Biga Pit to be potentially suitable for discharge to the Sigpit River, due to meeting the current water quality requirements apart from nitrates and phosphorous and given the existing levels of these anolytes.. [t]esting has also shown that the water quality could potentially be improved by simple filtering.

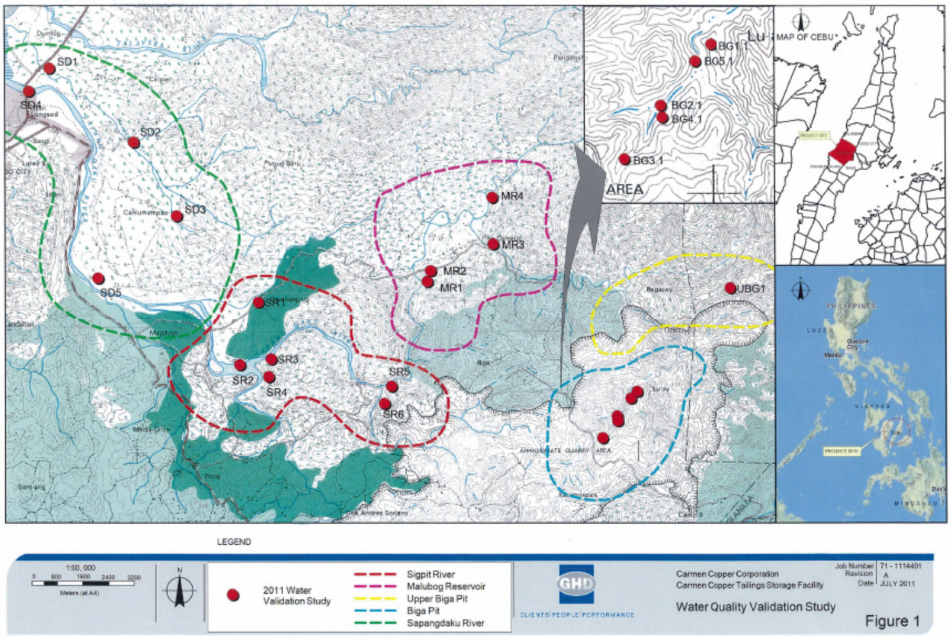


Fig. 2.51 Sampling Locations Map

Table 2.37 Biga Pit Samples (GHD Study)

Parameter	DAO 90-34	DAO 90-35	BG1.1	BG1.2	BG1.3	BG2.1	BG2.2	BG2.3	BG3.1	BG3.2	BG3.3	BG4.1	BG4.2	BG4.3	BG5.1	BG5.2	BG5.3
(mg/L unless Stated)																	
Year/Quarter			2011	2011	2011	2011	2011	2011	2011	2011	2011	2011	2011	2011	2011	2011	2011
Sample Date																	
Laboratory			F.A.S.T.	F.A.S.T.	F.A.S.T.	F.A.S.T.	F.A.S.T.										
Temperature (max rise in °C)	3	3	28.5	28.5	28.3	28.8	28.7	28.5	28.1	28.1	28.2	28.4	28.2	28.1	29.3	28.8	28.2
Dissolved Oxygen (min)	5		*4.82*	*4.46*	*4.73*	5.01	6.48	7.40	*4.69*	6.93	8.27	*4.72*	7.35	8.06	5.39	6.80	7.46
Electric Conductivity (uS/cm) [b]			3040	1953	1942	3150		3110	3160	3130	3120	3120	3120	3120	3120	3120	3120
Turbidity (NTU)[b]	-	-	137	144	129	127	114	114	53.4	115.8	63.6	52.2	102.9	78.8	49.6	68.4	119.0
Color (Apparent, PCU)	-	-	1	25	50	1	1	1	1	1	5	1	1	1	1	1	1
pH	6.5-8.5	6.0-9.0	7.10	7.10	7.20	7.10	7.10	6.90	7.00	7.20	7.10	7.20	7.30	7.30	7.30	7.30	7.30
TSS			3	12	276	4	7	6	4	12	1	4	8	12	4	8	4
Nitrogen (as NO_3)[a]	NR[c]	NR[c]	<0.42	41.40	678.00	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	84.40	78.80	22.70	39.50
Phosphorus (as PO_4)	0.2	NR[c]	<0.43	*0.63*	1.3	0.03	1.3	1.6	2.2	2.2	1.8	3.9	3.2	4.5	3.1	3	3.6
BOD_5	5	50	1.0	<1	2.0	6.0	1.0	4.0	2.0	<1	1.0	2.0	<1	<1	2.0	<1	<1
Oil and Grease[d]	1	5	<1	2	3	2	<1	6	6	6	13	6	13	3	3	4	3
Total Coliform (MPN/100ml)	1,000	5,000	2.0	11	2	<1.8	13	<1.8	23	27	23	>16000	13	7.8	2.0	17	79
Fecal Coliform (MPN/100ml)[b]	200		<1.8	2.0	<1.8	<1.8	<1.8	<1.8	23.0	7.8	<1.8	<1.8	2.0	<1.8	<1.8	<1.8	13.0
Chloride as Cl	-		24.0	24.0	25.0	25.0	24.0	24.0	25.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.0
Cyanide	0.05	0.20	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Arsenic (As) Total	0.05	0.20	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium (Cd)	0.01	0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chronium (Hexavalent, Cr^{6+})	0.05	0.1	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Copper (Cu)	0.05	-	<0.0025	<0.0025	<0.0025	0.0070	0.0030	0.005	<0.0025	0.006	0.0051	0.0054	0.0066	0.0046	0.0068	0.108	0.0075
Lead (Pb)	0.05	0.2	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Manganese (Mn)	-	-	0.0500	0.1500	0.0900	0.1100	0.0200	0.100	0.1152	0.0544	0.0506	0.0280	0.0853	<0.0075	0.0894	0.0184	0.0908
Mercury (Hg)	0.002		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel (N)			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Selenium (Se)			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)			0.030	0.050	0.050	0.020	0.040	0.020	0.033	0.037	0.026	0.027	0.017	0.016	0.044	0.030	0.036

RESULTS AND DISCUSSION (GHD Study). This discussion tackles the water quality at the different sites through a comparison between water quality within the Biga Pit and that of its potential receiving waters. Results for the Biga Pit are assessed against the DAO 90–35.

Temperature. The water temperature was recorded at each site as part of the monitoring program. The water temperature was unable to be assessed against DAO 90–35 Standards as no temperature information was available in the Baseline Study for comparison. Extensive testing would be required to assess long term seasonal effects on water temperature in order to prepare a new baseline water temperature level for the sampled sites.

Dissolved Oxygen. Biga Pit samples had DO levels ranging from 4.46 to 8.27 mg/L. For stations BG3 and BG4, samples taken at the surface yielded DO levels slightly below the minimum DO level prescribed by DAO 90-34. All three samples collected at different depths of BG1 yielded DO concentrations below the prescribed standard. In general, DO levels in Biga Pit increased as depths also increased. Station BG1 however, showed a decrease in DO as depths approached 20m and then increased again as depths approached 30 m.

For the river and lake samples, only SD3 had a lower dissolved oxygen level than prescribed by DAO 90–34 for Class B waters.

Electrical Conductivity. No baseline data is available for EC as CGK did not measure this parameter in 2007. DAO 90-34 does not prescribe limits or standards for EC for surface water samples. Nonetheless, information on EC, which estimates the amount of dissolved salts or dissolved ions in the water, may provide insight on how geochemical processes will proceed, identify presence of pollution sources of pollutants (Michaud, 1991; Moore, 1989). The Electrical Conductivity may additionally be utilised as a guide to determine Total Dissolved Solids.

Turbidity. No baseline data are available for turbidity as CGK did not measure this parameter in 2007. DAO 90-34 does not prescribe limits or standards for turbidity for surface water samples. Nonetheless, information on turbidity provides measurement of suspended solid matter in water, which may influence dynamics in aquatic communities (Michaud 1991; Moore 1989). Further information on sampling for Total Suspended Solids is described below.

At Biga Pit, turbidity ranged between 49.6 to 144 NTU. Within stations BG1, BG3 and BG4, samples collected at 20-m depth yielded higher turbidity compared to those collected at the 10 m and 30 m. For BG2 however, turbidity increased from near surface to up to 20 m below surface, but the sample taken from 30 m deep had the same turbidity as the one taken at 20 m deep. Station BG5 also had turbidity increasing as depth increased. This implies that at BG2 (i.e., close to BG4, middle of Biga Pit) and BG5 (i.e., north-eastern portion of the Biga Pit), colloidal particles tend to settle to the bottom. At BG1 (i.e., northeast of Biga Pit), BG4 (i.e., middle of Biga Pit) and at BG3 (i.e., southwest of Biga Pit) there seems to be a 'mixing' event that causes turbidity levels to increase until 20 m below the surface and then decrease as you approach 30 m depth.

At the Bagacay River upstream of Malubog Reservoir, turbidity was measured at 141.8 NTU. The shallow stream and gravelly-clay streambed may be factors contributing to turbidity in water samples taken on site. Malubog Reservoir stations had turbidity ranging from 43.9 to 141.6 NTU. Lowest turbidity was measured at MR2, whilst highest turbidity was found at MR3.

Turbidity in stations located along the Sigpit River ranged from 51.3 to 174.4. Station SR3 had the lowest turbidity whilst station SR4 had the highest turbidity. Low turbidity was found at stations where the streambed was made up of mostly pebbles, like SR1 and SR3. Highest turbidity was found in SR6 and this may be attributed to the water passing through the emergency tailings pond. It was noted that the water flowing through the stream was greyish in colour. Factors contributing to turbidity in SR5 could be the fact that residents frequent this shallow area of the river for fishing. Turbidity levels measured at SR4 may have been influenced by the bluish green coloured water flowing through the stream. The source of discolouration could not be identified.

Sapangdaku River and Dumlog River had water samples with turbidity ranging from 12.2 to 339 NTU. The lowest turbidity was found at SD1, whilst highest turbidity was found at SD5. Turbidity tends to decrease as water moves from SD5 to SD1 or from inland towards the sea. Higher turbidity found in SD5 may be related to the higher EC found in SD5 compared to stations located downstream. This implies that higher concentration of ions found upstream may be causing the higher levels of turbidity at upstream locations, like SD5. Sampling at SD5 and SD4 also occurred after a rainfall event, thus making the shallow water temporarily retain a brown murky colour.

pH. Apart from comparing results of the water validation study to the 6.5 to 8.5 pH range specified by DAO 90-34, results were also compared with baseline values for pH measured during the 2007 Environmental Baseline Study conducted by CGK. In situ measurements of pH for samples collected in Biga Pit ranged from 6.90 to 7.70, whilst laboratory measurements of pH ranged from 6.90 to 7.30. In general, *in situ* measurements tend to be higher compared to laboratory measurements of pH. Stations BG1, BG2 and BG4 had increasing pH as depths increased. BG3 and BG5 had varying pH levels as depths increased, but were generally within a 0.08 range. Values for pH were quite different from the

acidic baseline values measured in 2007, which ranged between 2.4 to 2.6. Nonetheless, current levels of pH in the Biga Pit appear to have improved as these are within the DAO 90-34 standards.

For the Bagacay River, in situ and laboratory analysis yielded 8.36 and 8.10, respectively. These values were slightly above the baseline range measured in 2007, which is 4.5 to 8. These pH values however, are still within the prescribed DAO 90-34 standards.

At the area covered by the Malubog Reservoir, in situ pH levels ranged between 7.69 to 8.45, whilst laboratory analysed samples had pH levels ranging from 7.10 to 8.30. Only MR4 had a pH reading that did not fall within the 7.4 to 8.5 baseline range. This however, does not pose a significant issue as pH levels are within the DAO 90-34 standards.

The in situ pH measurements in Sigpit River ranged from 7.60 to 8.11, whilst pH measured in the laboratory ranged from 7.50 to 7.90. The in situ and laboratory analysed pH measurements from SR1, SR5 and SR6 were within the baseline pH range of 3.1 to 7.6. Nonetheless, exceedance of the baseline range by samples taken from SR2, SR3 and SR4 is not a significant issue as measured pH levels are within the DAO 90-34.

Samples collected along the Sapangdaku River and Dumlog River have *in situ* pH levels ranging from 6.64 to 7.76, whilst samples analysed in the laboratory yielded slightly lower pH levels ranging from 6.60 to 7.50. Only station SD3 and SD5 yielded pH levels within the baseline values (i.e., 6.9 to 7.4), but nonetheless, pH levels in Sapangdaku River stations are within the prescribed 6.5 to 8.5 pH range by DAO 90-34.

Overall, pH levels in some stations may be outside the baseline pH levels measured in 2007, but the range of pH in the sampling stations comply with DAO 90-34 standards. In addition, having no stations with acidic pH levels are an indication of improved water quality across sampling stations.

Total Suspended Solids (TSS). The DAO 90-34 does not prescribe a specific number for Total Suspended Solids (TSS), but rather a limit to the increase in TSS levels as compared to baseline values, which is less than 30%.

Biga Pit stations have TSS ranging from 3 to 276 mg/L. Within the five locations, the lowest TSS were found in samples collected near the surface. Within BG3 and BG5, TSS was the highest at 20 m depth. Station BG2 had the same amount of TSS at all three depths sampled for, whilst BG1 and BG4 had the highest TSS at 30 m. Baseline values for this sampling area during the wet season are not available, so dry season baseline data were used instead. Baseline TSS levels in Biga Pit ranged from 41 to 56 mg/L.

Results show that TSS from Biga Pit during the time of sampling comply with the DAO 90-34 standards and are within the baseline levels of TSS, except for the sample taken from 30 m below the surface at BG1, which had 276 mg/L TSS.

For the Bagacay River, baseline TSS levels are between 21 to 25 mg/L. As such, an acceptable value for
TSS increase is 27.3 to 45.5 mg/L. Station UBG1 only had 4 mg/L of TSS, which is within the DAO 90-34 standard. This measurement is also very low compared to the baseline measurements made in 2007. The four stations situated around the Malubog Reservoir have TSS that ranges from 4 to 17 mg/L. This range complies with the DAO 90-34 standards and is below the baseline TSS range of 9 to 573 mg/L.

Along Sapangdaku River and Guinkuiyutan River, TSS ranged between 9 to 486 mg/L. These values fall within the baseline range for TSS and comply with DAO 90-34 standards. Samples taken from Sigpit River have TSS levels ranging from 6 to 399 mg/L. The lowest amount of TSS was found in SR5, whislt the highest amount of TSS was found in SR6. Amounts of TSS were comparable to baseline data collected in 2007, which is 9 to 2,739 mg/L. Overall, TSS levels in the Bagacay River, Sapangdaku

River, Sigpit River, Malubog Reservoir and Biga Pit are acceptable and do not pose potential risks to environmental health when baseline and DAO 90-34 standards are considered. The sample taken from BG1 at 30 m depth indicates that in general, suspended solids tend to sink to the bottom of the basin or streambed, resulting in higher TSS values at lower depths.

Color. Baseline data on colour was not acquired during the 2007 sampling study conducted by CGK. DAO 90-34 does not prescribe any standard for water colour in Class B waters, however colour was recorded for future reference and development of baseline conditions.

Nitrates. The 2007 Baseline Environmental Study did not measure nitrates in various water sampling stations. DAO 90-34 does not recommend any nitrate concentration for Class B waters, however nitrate levels were recorded for future information and development of baseline conditions.

For the Biga Pit, nitrates ranged from <0.42 to 678 mg/L. Samples collected from BG1.1, BG2, BG3, BG4.1 and BG4.2 had nitrates below the detection limit. Samples from BG1 and BG4 showed an increase in nitrates as depths increased, whilst BG5 had varying nitrate concentrations as depths increased. Given that the water from the Biga Pit is mostly composed of tailings from the Lutopan Mine and rainfall, nitrates in the water may potentially come from the substrate and potentially gets concentrated at lower depths where colloidal substances tend to settle.

The sample collected from the Bagacay River yielded 67.50 mg/L of nitrates, which is considered high. The high nitrate content could potentially come from nitrate rich soil surrounding the area where banana trees and grass are found.

Samples collected from the Sigpit River also reported high nitrate concentrations, except for the sample taken from SR6. Nitrate concentrations ranged from 5.90 to 585 mg/L. It must be noted that water that passes through SR6 comes from the emergency tailings pond and is 10 to 20 m away from the mine treatment facility. This implies that potentially, water from the Gabion Dam and Sigpit settling pond have very low nitrate content as opposed to water flowing through areas that are not impacted by the mine and are mostly near agricultural paddies or residential areas. Similar to what was observed in Sapangdaku River and Guinkuiyutan River, nitrate concentrations along the Sigpit River tend to decrease as water flows into the sea.

High Nitrate connectrations were also observed in the Sapangdaku River and Dumlog River samples. Nitrate concentrations ranged between 9 to 2,245 mg/L in the five stations. Nitrate concentrations appeared to decrease as water flows from inland towards the sea. Sources of nitrate in these stations may include pesticide runoff or nitrate rich soil utilised for vegetation and agricultural paddies (i.e., SD1, SD2, SD3), animal waste (i.e., SD4, SD5), human waste (i.e., SD2 SD3), and a piggery (i.e., SD2).

In general, sampling stations that have high nitrate concentrations appear to come form sources other than the mine. Caution must be taken when releasing water from the Biga Pit prior to recommencing mining in the pit as nitrate concentrations in Biga Pit are relatively higher compared to surrounding receiving waters. Releasing water from Biga Pit without treatment may cause eutrophication in downstream areas. The information gathered on Nitrates would be considered suitable for future reference and comparison against future baseline studies.

Phosphates. The 2007 Baseline Environmental Study did not measure phosphates in various water sampling stations. DAO 90-34 recommends 0.2 mg/L as the limit for phosphate concentration for Class B waters.

Only two samples taken from Biga Pit had phosphate concentrations within the prescribed standards. These samples were taken at BG1.1 and BG2.1, which were both taken near the surface. Phosphate concentrations in Biga Pit that exceeded the DAO 90-34 standards range from 0.63 to 4.50 mg/L. Within stations BG1, BG2, BG4 and BG5, phosphate concentrations generally increased as depths increased, whilst BG3 posed a slight decrease as depths increased.

Phosphate concentrations in the UBG1 exceeded DAO 90-34 standards as it yielded 3.7 mg/L of phosphate. Exceedance of the prescribed phosphate concentration may be due to phosphorous-rich soil.

The four stations located in the Malubog Reservoir had phosphate concentrations below detection limits.
All six stations along Sigpit River also had phosphate concentrations below detection limits. Of the five samples taken along Sapangdaku River and Dumlog River, only the sample taken from SD1 with 1.50 mg/L, exceeded the prescribed standard for phosphate concentrations. The other four sampling stations had phosphate levels below the detection limit.

Based on laboratory results, phosphate concentrations were detected in stations located in the Bagacay River upstream of Malubog Reservoir (UBG1), in Biga Pit and at SD1, which is near the river mouth. Given that nearby freshwater bodies have very low concentrations of phosphates, releasing the water from the Biga Pit may pose negative effects on streams, including eutrophication. Phosphate concentrations in water need to be lowered prior to discharge into streams. Detected concentrations of phosphate at SD1 may be due to accumulation of nutrients as water logging in the area prevents water flow in this stream.

Biological Oxygen Demand (BOD). DAO 90-34 specifies 5 mg/L as the limit for Biological Oxygen Demand (BOD) concentration for Class B water bodies. However, DAO 90–35 specify a 50 mg/L limit for effluents discharged into Class B waters.

Two river water samples exceeded the 5 mg/L limit for BOD for Class B waters, and these were SD1 in Dumlog River near the rivermouth and SR6 along the lower Sigpit River.

None of the Biga Pit samples exceeded the maximum limit of DAO 90–35 for BOD, only BG2.1 exceeded the maximum limit specified by DAO 90–34.

Oil and Grease (O&G). Baseline data on O&G are not available as this parameter was not sampled by CGK in 2007. Nonetheless, DAO 90-34 prescribes a limit to O&G in water samples taken from Class B waters, which is 1 mg/L.

At the Biga Pit, two samples taken near the surface had non-detected O&G, whilst other samples had O&G ranging from 2 to 13 mg/L. Most samples taken at 30-m depths had higher O&G concentrations compared to samples taken at lesser depths.

The sample taken from UBG1 had 2 mg/L O&G concentration, which is slightly above the DAO 90-34 standard. Malubog Reservoir stations had O&G ranging from 1 to 4 mg/L. Only one station, MR3, had O&G concentrations within the prescribed limit by DAO 90-34. The four other stations had 3 to 4 mg/L of O&G. Anthropogenic activities along the river are the most likely source of O&G in the sampled stations.

At Sigpit River stations, O&G ranged from concentrations below detection limit to 19 mg/L. The highest O&G concentration was found in SR6, whilst the downstream stations SR2, SR3 and SR4 had O&G ranging from 3 to 3 to 5 mg/L. The source of O&G at SR6 may be from the emergency tailings pond, whilst source of O&G at downstream stations could be anthropogenic sources like domestic and agricultural activities.

Sapangdaku River and Dumlog River samples had one station with O&G concentration below detectable levels (i.e., SD1). The remaining four water quality sampling stations however, had O&G ranging from 23 to 30 mg/L, which exceeds the prescribed standard by DAO 90-34 by above twenty-fold. Identified contributors to O&G along the Sapangdaku River may be due to anthropogenic acitivities, including agricultural activities near SD3 and SD5 and a piggery near SD2.

Most samples taken along the rivers have exceeded the DAO 90-34 standard for O&G. The highest range of O&G detected was found in Sapangdaku River stations followed by those collected in Sigpit River, Biga Pit, Malubog Reservoir and Upper Biga Pit.

Total and Faecal Coliform. No baseline data were gathered for Total Coliform (TC) and Faecal Coliform (FC) during the 2007 baseline study. DAO 90-34 prescribes a limit to TC and FC in Class B waters, which are 1,000 MPN/100mL and 200 MPN/100 mL, respectively.

Biga Pit samples had varying TC and FC as analyses yielded a TC range from below detectable limits to greater than 16,000 MPN/mL and an FC range from below detectable limits to 23 MPN/100 mL. Only the sample collected at BG4.1 exceeded the DAO 90-34 standard for TC, however this appears anomalous.
Biga Pit samples complied with DAO 90-34 standards for FC.

At UBG1, TC and FC were 280 MPN/100 mL and 11 MPN/100 mL, respectively. These values are within the prescribed standards for TC and FC. Stations MR1, MR2 and MR3 exceeded the limit for TC set by DAO 90-34. Whilst MR4 had not detectable concentrations of TC, the three aforementioned stations had TC ranging from 1,600 to 16,000 MPN/100 mL. MR4 had no detected concentrations of FC as well, whilst MR1, MR2 and MR3 had FC ranging from 280 to 920 MPN/100 mL. These stations exceeded the standards set by DAO 90-34 for FC in Class B waters.

TC count in samples taken at Sigpit River and its tributaries ranged from levels below detection limits to greater than 16,000 MPN/100 mL. Samples taken from SR1 and S3 exceeded the TC standard set by DAO 90-34. Only SR4 had FC below detection limits, whilst the five other samples had FC ranging from 17 to 2,200 MPN/100 mL. Stations SR1, SR2 and SR3 exceeded the DAO 90-34 standard for FC.

Samples collected from along the Sapangdaku River had TC and FC within the Draft DAO 2008 and DAO 90-34 standard. Samples collected along the Dumlog River had TC ranging from 3,500 to 5,400 MPN/100 mL and FC ranging from 1,600 to >16,000 MPN/100 mL. Highest TC and FC concentrations found in SD2 may potentially be due to its proximity to a small-scale local piggery and agricultural paddies.

It appears that TC and FC in Biga Pit are generally lower as opposed to stations along Dumlog River, Sigpit River and Malubog Reservoir. Contributors to TC and FC concentrations are mostly anthropogenic activities in agricultural paddies and piggery farms.

Chloride. The baseline study conducted by CGK in 2007 did not include measurements of Cl. Information gathered from the sampling program will be useful for future baseline comparison studies.

Cyanide. All samples showed non-detectable amounts of cyanide.

Hexavalent Chromium (Cr6+). Laboratory results were compared with baseline data on levels of Cr6+ in various sampling stations, as well as the standards set by DAO 90-34, which is 0.05 mg/L.
Samples collected from the Upper Biga Pit, Sapangdaku River, Sigpit River and Malubog Reservoir had
Cr concentrations below detectable limits for the test methods used.

At Biga Pit, the baseline range falls between 3.5 to 5.8 mg/L of Cr6+. For this study, most samples had Cr below detected concentrations, except for three samples taken from BG1.1, BG1.2 and BG2.1. Detected
Cr6+ ranged from 0.026 to 0.029 mg/L. These comply with the DAO 90-34 standard.

Magnesium (Mg). Magnesium was not tested during this study. It is however understood that Magnesium, in the form of Magnesium Sulphate (MgSO4), may be prevalent at and around the mine.

It is recommended that any future testing should include Magnesium, as dissolved Magnesium is related to both water hardness and Chromium concentrations.

Other metals. No other metals tested during this sampling activity exceeded the DAO 90-34 limits.

Total Dissolved Solids. Total Dissolved Solids (TDS) were not measured during the testing program; however Electrical Conductivity (EC) may be used to estimate the amount of TDS at the sample locations. An approximate relationship between Electrical Conductivity (µS/cm) and TDS (ppm) may be established by multiplying the measured EC by a factor of 0.5 to 0.7. This relationship generally indicates that the Biga Pit may have TDS in excess of 1800ppm. All other sampled sites are generally lower, around 200 to 600ppm, with the exception of some higher reading from sampled locations downstream

Water Treatment Options. As previously discussed the recent round of testing has shown the water quality in Biga Pit to be potentially suitable for discharge to the Sigpit River, due to meeting the current water quality requirements apart from nitrates and phosphorous and given the existing levels of these anolytes in that river.

Testing has also shown that the water quality could potentially be improved by simple filtering.

2.2.6 Mitigation and Enhancement Measures

2.2.6.1 Construction Phase

The project component that involves 'construction' are the following:

- the development of the Dike at Biga Pit's north face and the
- tailings pipeline from Carcon for Biga TSF enhancement;
- Marcona WRD development (buttress, sedimentation ponds, drainage canals, access roads, etc).
- Airstrip Waste Rock Dump expansion

Table 2.38 **TSF Construction Phase Impact Characterization on Water**

Environmental Component	Potential Environmental Impact	+/-	Impact Intensity	Extent (impact area)	Duration	Timing	Frequency	Likelihood of occurrence	Value of Affected Component	Risk to Human Pop.	Effect of impact
Surface Water	Erosion of exposed topsoil by construction activities (removal of soil and woodland) may impact on surface watercourses through soil erosion and contamination	-	Mode-rate	primary	Short term	Const	Infrequent	Possible	Low	Low	Flora & fauna
	Removal of soil and vegetation will change the nature of the watershed feeding the project watercourses	-	High	Primary	Long term	Const	Continuous	Certain	Low	Low	None
	Contamination of water from the accidental release of hydraulic fluid, oil or fuel from construction vehicles	-	Mode-rate	Primary	Medium term	Const	Continuous	Possible	Low	Low	Flora & Fauna
Ground water	Contamination of groundwater from the accidental release of hydraulic fluid, oil or fuel from the construction vehicles	-	High	Primary	Perma-nent	Const	Continuous	Certain	Low	Low	None

2.2.6.2 Operation Phase

Impact Identification and Assessment

The Biga TSF enhancement and Marcona WRD impacts on water quality are mainly influence by discharges of Biga Pit overflow relief water, seepage (for both TSF and WRD) and the surrounding drainage (run-off)

a) Hydrology/Flooding
   - Discharges of Biga Pit overflow relief water influence excessive increase in volume of Sigpit river flowrates causing flooding in downstream (lower sigpit and sapangdaku) areas
   - Destruction or Loss of crops, farmlands, properties (houses) and possibly lives due to flooding caused by excessive/inappropriate discharges of Biga Pit overflow relief water. Other effects of excessive discharges includes:
     - Contamination/silting of river systems (Sigpit Creek to Sapangdaku River) resulting to loss of water source, possible loss of food source due to immigration of aquatic fauna species, and damage to river water ecology
     - Silting of rice paddies or farm land located downstream because of contaminated irrigation water;
     - Flooding of downstream communities; and
     - Contamination/silting of coastal ecosystems along the coasts of Toledo City and the Municipality of Balamban.

b) Hydrogeology. Penetration of pollutants/ heavy metals at Biga Pit's bottom causing groundwater contamination. Penetration of ARD in Marcona WRD

c) Water Quality
   - Transport of water-borne contaminants from Biga Pit TSF through the overflow relief water/discharges
   - Soil Erosion and sedimentation increases suspended particulates in surface water. degrading surface (river) water quality. Surface run-off causing erosion and transporting sediments from surrounding areas going into the peripheral drainage canals and the Biga Pit itself

Closure of Tailings Facilities
The risk of catastrophic failure of a tailings impoundment is generally accepted as being the greatest during the operational phase, and decreases when inactive due to drainage of the excess water, consolidation of the tailings materials and a general aging of the tailings materials. However, a closed tailings facility can still present an appreciable risk. Continued seepage and drainage of low quality water can impact surface and ground water, requiring long-term, active management. Inadequately designed surface water diversion/control channels and spillways can fail during extreme precipitation events, leading to off-site environmental impacts requiring mitigation. Post-closure risks are mitigated through conservative closure design coupled with a program to monitor the closed facility and make timely corrective actions

Mitigation Measures

The applied Biga Pit overflow relief water volume of discharge (17,500 cu.mtrs/day) is within the safe limits that the outfall (Lower Sigpit Creek and Sapangdaku River) can effectively handle without causing flooding on the downstream areas, however, there is a need to institute the following measures:

- Control releases of discharges not to exceed the allowable limits/thresholds applied/covered in this ECC (17,000 cum/day);
- No discharges of Biga Pit overflow relief water during heavy rainfall and storms/typhoons

While it is highly unlikely (should the above measures be implemented), in the event of excessive discharge which may result to disastrous/destructive flooding, the following measures will be undertaken:

- Adequate and proper compensation for loss, destroyed and damaged, farmlands, crops, properties, etc.
- Devise and implement detection and early warning system,
- CCC involvement in community disaster risk management initiative
- Immediately conduct clean up of the affected river systems and coastal areas. Likewise, appropriate rehabilitation of the affected river and coastal areas will be implemented after the clean up; and
- Affected farmers and community members will be justly compensated of their damages.

Preparation of Emergency/Contingency Response Plan

Penetration of pollutants/ heavy metals at Biga Pit's bottom causing groundwater contamination:

- Commissioning of new 'permeability or leaching test/analysis;
- Establish buffer area/zone where potable water extraction will not be allowed
- Establish monitoring wells to constantly and regularly monitor the possibility of ground and aquifer contamination

Transport of water-borne contaminants from Biga Pit TSF through the overflow relief water/discharges:

- Provision of Sedimentation Pond/ Water Treatment facility (after or before the Decant Tower and the rehabilitated Sigpit Dam sedimentation pond)
- Dilution by the water inflow
- Dilution by lime additiveM
- Water recovery & treatment
- Physical & chemical treatment for specific type of pollutants (heavy metals)

Soil Erosion and sedimentation increases suspended particulates in surface water. degrading surface (river) water quality. Surface run-off causing erosion and transporting sediments from surrounding areas going into the peripheral drainage canals and the Biga Pit itself

- Retain sediment on-site (within Toledo Copper Mines) through putting-up of sediment pond or a series of catch basins (berms and silt traps) for the peripheral stormwater run-off drainage canal to prevent sediments from going into the Cumba River and other drainage outfalls.
- Improve/enhance drainage system immediately surrounding Biga Pit (right after road) through the following: a) road side (Biga Pit side) drainage canal with cross-drains for run-off to be directed to the opposite canal (leading to River outfall) and not to Biga Pit
- As practicable as possible, installation of contour drains (perforated pipes) around the upper walls of Biga Pit

Water Supply/Water Resource Competition with the Community. CCC has provided 6.6M Php for the construction and establishment of the Barangay Biga Water Supply System. It also has provided 1.99M Php for the relocation of the deep well within the Marcona WRD project site. With such program/project that provides water source for the community CCC did not compete with the commuity's water source, besides, the mining operations main source of water supply is the Malubog reservoir which is not located in the vicinity of the projects in Brgy. Biga

Environmental Performance/Mitigation and Enhancement Measures for *'Water'* Component

Assessment for Environmental Performance is primarily based on the project's compliance to the EMP of the Toledo Copper Mine Tailings Disposal Facilities-Sigpit Creek (Interim) & Biga Pit PEPRMP, which was issued ECC No. 070612-290278120, dated Dec. 29, 2006. However, the Sigpit Creek

(Interim) TSF project was shelved and no development activities whatsoever were undertaken in the area, thus, there was no implementation of the EMP. While in the Biga Pit area, mitigation and enhancement measures are being put-in-placed to address specific concerns.

The following table exhibits the existing (that will be continued) and proposed mitigation/enhancement measures to address identified environmental impacts on 'WATER' of the enhanced Biga TSF (existing operations and proposed amendments-new developments).

Table 2.39 **Environmental Performance-Enhancement/Mitigation Measures of Impacts on "Water"**

Environmental Parameters	***Impacts***	***Mitigation/Enhancement Measures***
Hydrology/ Flooding	Discharges of Biga Pit overflow relief water influence excessive increase in volume of Sigpit river flowrates causing flooding in downstream (lower sigpit and sapangdaku) areas	• Control releases of discharges not to exceed the allowable limits/thresholds applied/covered in this ECC (17,000 cum/day) • No discharges of Biga Pit overflow relief water during heavy rainfall and storms/typhoons • Consistent/efficient monitoring & feedback of weather/climate patterns (esp. weather disturbances, and amount of rainfall)
	Destruction or Loss of crops, farmlands, properties (houses) and possibly lives due to flooding caused by excessive/in-appropriate discharges of Biga Pit overflow relief water. Other effects of excessive discharges includes: • Contamination/silting of river systems (Sigpit Creek to Sapangdaku River) resulting to loss of water source, possible loss of food source due to immigration of aquatic fauna species, and damage to river water ecology • Silting of rice paddies or farm land located downstream because of contaminated irrigation water; • Flooding of downstream communities; • Contamination/silting of coastal ecosystems along the coasts of Toledo City and the Municipality of Balamban.	• Adequate and proper compensation for loss, destroyed, damaged, farmlands, crops, properties, etc. • Devise and implement detection and early warning system, • CCC involvement in community disaster risk management initiative • Immediately conduct clean up of the affected river systems and coastal areas. Likewise, appropriate rehabilitation of the affected river and coastal areas will be implemented after the clean up; and • Affected farmers and community members will be justly compensated of their damages. • Preparation of Emergency/Contingency Response Plan
Hydrogeology	Penetration of pollutants/ heavy metals at Biga Pit's bottom causing groundwater contamination	• Commissioning of new 'permeability or leaching test/analysis; • Establish buffer area/zone where potable water extraction will not be allowed • Establish monitoring wells to constantly and regularly monitor the possibility of ground and aquifer contamination
Water Quality	Transport of water-borne contaminants from Biga Pit TSF through the overflow relief water/discharges	• Provision of Sedimentation Pond/ Water Treatment facility (after or before the Decant Tower and the rehabilitated Sigpit Dam sedimentation pond) • Adequate/proper number of monitoring/sampling points • Dilution by the water inflow • Dilution by lime additive • Water recovery & treatment • Physical & chemical treatment for specific type of pollutants (e.g phosphate & nitrates) which may exceed the standards)

Environmental Parameters	***Impacts***	***Mitigation/Enhancement Measures***
	Soil Erosion and sedimentation increases suspended particulates in surface water. degrading surface (river) water quality. Surface run-off causing erosion and transporting sediments from surrounding areas going into the peripheral drainage canals and the Biga Pit itself	• Retain sediment on-site (within Toledo Copper Mines) through putting-up of sediment pond or a series of catch basins (berms and silt traps) for the peripheral stormwater run-off drainage canal to prevent sediments from going into the Cumba River and other drainage outfalls. • Improve/enhance drainage system immediately surrounding Biga Pit (right after road) through the following: a) road side (Biga Pit side) drainage canal with cross-drains for run-off to be directed to the opposite canal (leading to River outfall) and not to Biga Pit • As practicable as possible, installation of contour drains (perforated pipes) around the upper walls of Biga Pit
	Contami-nation of surface watercourses due to the release of WRD Contaminated run-off	• Implementation of the Waste Rock Mgt Plan, • Should there be a need (depending on the results of the Waste Characterization study- a containment facility for PAF materials will be established • Establishment of appropriate Wastewater Treatment Facility in consideration of the Waste Characterization study
	Contamination of groundwater due to acid rock drainage (ARD) through the base or the toe of the dump.	• The waste rock will b dumped such that all potentially acid forming wastes will be dumped in the center of the dump. • surface capping to insulate against the infiltration, percolation and contaminant migration via rainfall through the waste dump. Surface capping materials may be impermeable materials such as clay, concrete or liners; and • adequate waste dump drainage to confine runoff to the surface, where it may be more easily contained and treated if required. • Implementation of the Waste Rock Mgt Plan, • Should there be a need (depending on the results of the Waste Characterization study- a containment facility for PAF waste materials will be established • Establishment of appropriate Wastewater Treatment Facility if applicable/dependent on the results of the Waste Characterization study

2.3 The AIR

2.3.1 Meteorology/Climatology

Climate. The climate of Cebu was classified by Coronas (1920) as the third type of four classes. Under the third type classification, the area has no pronounced maximum rain, and has a short dry season lasting usually in March to May. Coronas classification is mainly based on rainfall characteristics using the average monthly distribution of rainfall over the archipelago. On the other hand, according to Hernandez (1954) Cebu belongs to type C climate with rain sufficiently distributed and with 4 to 4.5 dry months. Under this system, a month with a rainfall of 60 mm or less is considered dry. While a month with more than 100 mm is considered wet. Wettest months normally occur in June to November and relatively wet months are in December and January, while the dry months fall in February to May. In a dry year the dry months could fall in February to June. A long dry period was experienced in the years 1968, 1983, 1987 and 1992. Lately, some meteorologists attributed these dry years to the so-called 'El Nino Southern Oscillation' an anomaly in sea temperature and atmospheric pressure, which occurs in the southern Pacific.

Monthly Rainfall . The monthly rainfall readings from Mactan Station during the period 1985-1997 will be presented in Figure 4.13(a). The rainy season starts in June and ends in November. Dry season follows in December until May.

Table 2.40 **Rainfall Data from CCC Biga Pit Monitoring Station**

Year	Jan			Feb			Mar			Apr		
	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays
2007	14.66	0.47	14	1.39	0.05	6	0.76	0.02	2	3.75	0.13	7
2008	13.98	0.45	19	16.83	0.58	16	11.00	0.35	11	21.79	0.73	10
2009	21.01	0.68	15	14.31	0.51	11	2.87	0.09	8	21.13	0.70	15
2010	7.21	0.23	12	1.98	0.07	8	0.51	0.02	4	7.49	0.25	10
2011	24.24	0.78	22	10.69	0.38	11	15.01	0.48	19	5.02	0.17	10
Year	**May**			**Jun**			**Jul**			**Aug**		
	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays
2007	32.02	1.03	12	21.66	0.72	12	26.11	0.84	15	37.99	1.23	13
2008	17.13	0.55	16	31.88	1.03	12	18.75	0.60	18	27.33	0.88	13
2009	14.22	0.46	12	22.03	0.73	18	25.30	0.82	19	16.79	0.54	11
2010	0.56	0.02	2	29.12	0.97	12	20.19	0.65	21	38.41	1.24	17
2011	27.38	0.88	22	13.98	0.47	16	18.11	0.58	18	24.13	0.78	19
Year	**Sep**			**Oct**			**Nov**			**Dec**		
	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays
2007	33.72	1.12	22	30.62	0.99	21	27.06	0.90	14	8.96	0.29	15
2008	16.98	0.57	13	20.94	0.68	16	19.02	0.63	12	15.64	0.50	12
2009	13.59	0.45	16	3.61	0.12	8	53.37	1.78	14	4.27	0.14	7
2010	23.47	0.78	18	29.34	0.95	18	7.87	0.26	11	4.27	0.14	7
2011	10.90	0.36	9	33.43	1.08	18	6.07	0.20	8			

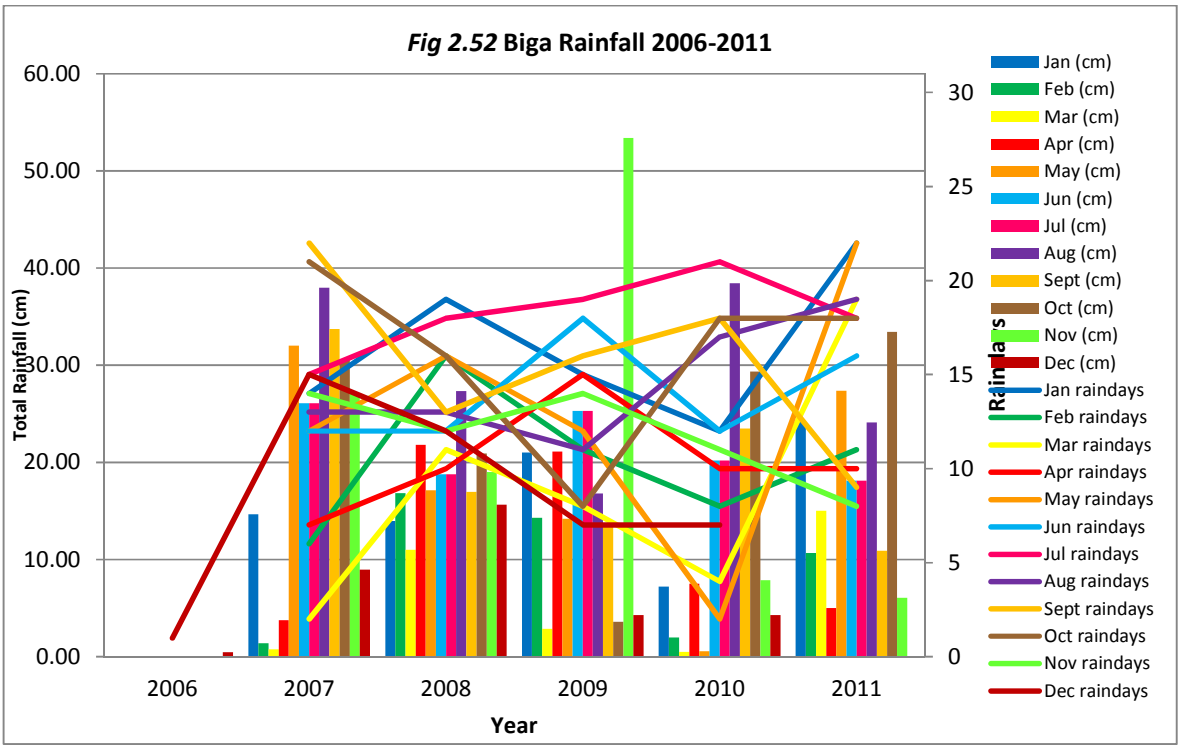


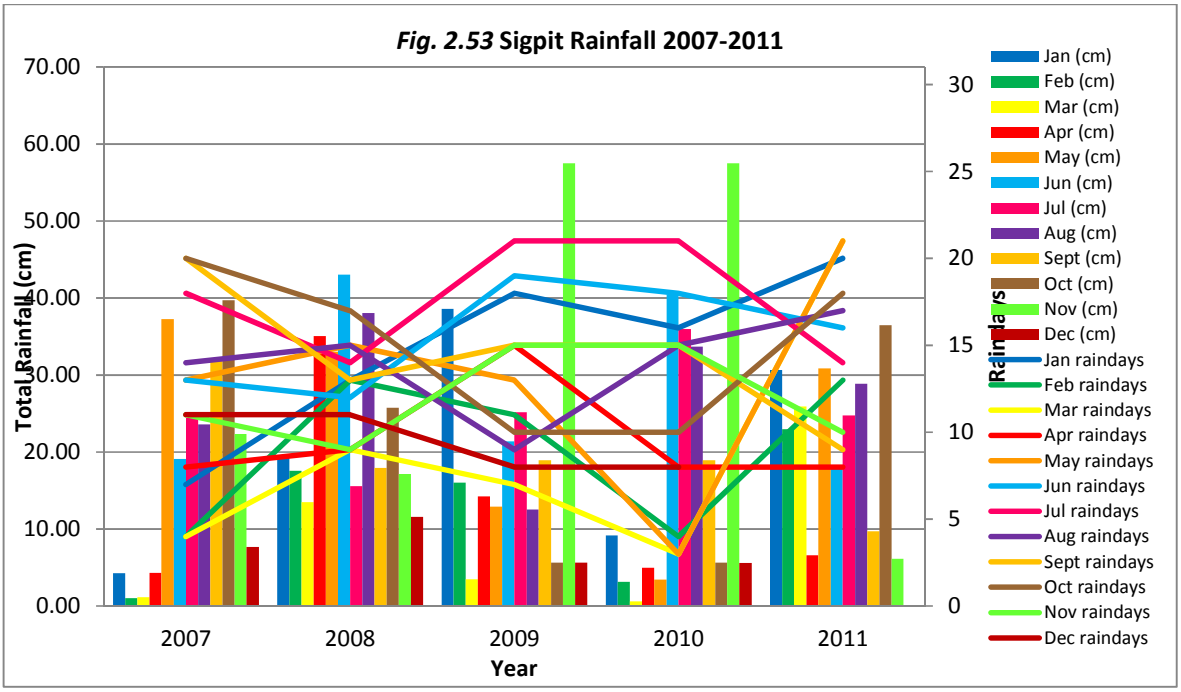
Table 2.41 Total **Rainfall SIGPIT RIVER** 2007-2011

Year	Jan			Feb			Mar			Apr		
	Total (cm)	Ave (cm)	Rain-Days	Total (cm)	Ave (cm)	Rain-days	Total (cm)	Ave (cm)	Rain-days	Total (cm)	Ave (cm)	Rain-days
2007	4.28	0.31	7	1.01	0.04	4	1.13	0.04	4	4.30	0.14	8
2008	19.63	0.63	13	17.57	0.61	13	13.47	0.43	9	35.10	1.17	9
2009	38.60	1.25	18	16.03	0.57	11	3.48	0.11	7	14.25	0.47	15
2010	9.17	0.30	16	3.15	0.11	4	0.64	0.02	3	4.95	0.17	8
2011	30.66	0.99	20	22.96	0.82	13	25.96	0.84	21	6.60	0.22	8

Year	May			Jun			Jul			Aug		
	Total (cm)	Ave (cm)	Rain-days	Total (cm)	Ave (cm)	Rain-days	Total (cm)	Ave (cm)	Rain-days	Total (cm)	Ave (cm)	Rain-days
2007	37.29	1.20	13	19.11	0.64	13	24.42	0.79	18	23.60	0.76	14
2008	33.02	1.07	15	43.05	1.39	12	15.60	0.50	14	38.05	1.23	15
2009	12.90	0.42	13	21.41	0.71	19	25.15	0.81	21	12.55	0.40	9
2010	3.45	0.11	3	40.46	1.35	18	35.99	1.16	21	33.73	1.09	15
2011	30.86	1.00	21	18.01	0.60	16	24.79	0.80	14	28.89	0.93	17

Year	Sep			Oct			Nov			Dec		
	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays	Total (cm)	Ave (cm)	Raindays
2007	32.21	1.07	20	39.73	1.28	20	22.35	0.75	11	7.69	0.25	11
2008	17.93	0.60	13	25.76	0.83	17	17.15	0.57	9	11.61	0.37	11
2009	18.94	0.63	15	5.63	0.18	10	57.53	1.92	15	5.62	0.18	8
2010	18.94	0.63	15	5.63	0.18	10	57.53	1.92	15	5.61	0.18	8

2011	9.75	0.33	9	36.51	1.18	18	6.12	0.20	10			



Winds. The principal air streams which affect the area are the Southwest Monsoon ("habagat") and the North Pacific Trades. It is partly sheltered from the Northeast Monsoon ("amihan"). The Southwest Monsoon comes from Indian Ocean, crosses the equator and reaches the country from the southwest. The North Pacific Trades are generally dominant during April and May. This air mass is extremely warm and humid and comes to the area from variable directions ranging from the northeast to the southeast. The Northeast Monsoon prevails during the months of November to March exhibiting maximum intensity during January and February. It is a relatively cold and less humid air mass as it originates from the intensely cold anticyclone over continental Asia during winter. *The climatological averages show that the most frequent wind directions are northeast and southwest. The northeast winds are most frequent in the months of November to May while the southwest winds prevail from June to October.*

Table 2.52 shows that the wind speed that ranges from 3.2 to 5.4 m/s. The highest wind speed occurs in the months of March and November in the northeastern direction.

Table 2.42 **Prevailing and Extreme Wind Direction and Speed**

Month	Direction	Mean	Minimum	Maximum
January	NE	5.1	3.0	7.0
February	NE	5.2	3.0	7.0
March	NE	5.4	3.0	8.0
April	NE	4.8	2.0	6.2
May	NE	3.8	2.0	6.0
June	SW	3.3	2.0	5.2
July	SW	3.3	2.0	5.2
August	N	3.7	2.0	6.4
September	SW	3.3	2.0	5.0

October	SW	3.2	2.0	5.0
November	NE	3.9	2.0	8.0
December	NE	4.0	3.0	7.0
Annual	**NE**	**4.2**	**3.2**	**5.2**

Source: PAGASA

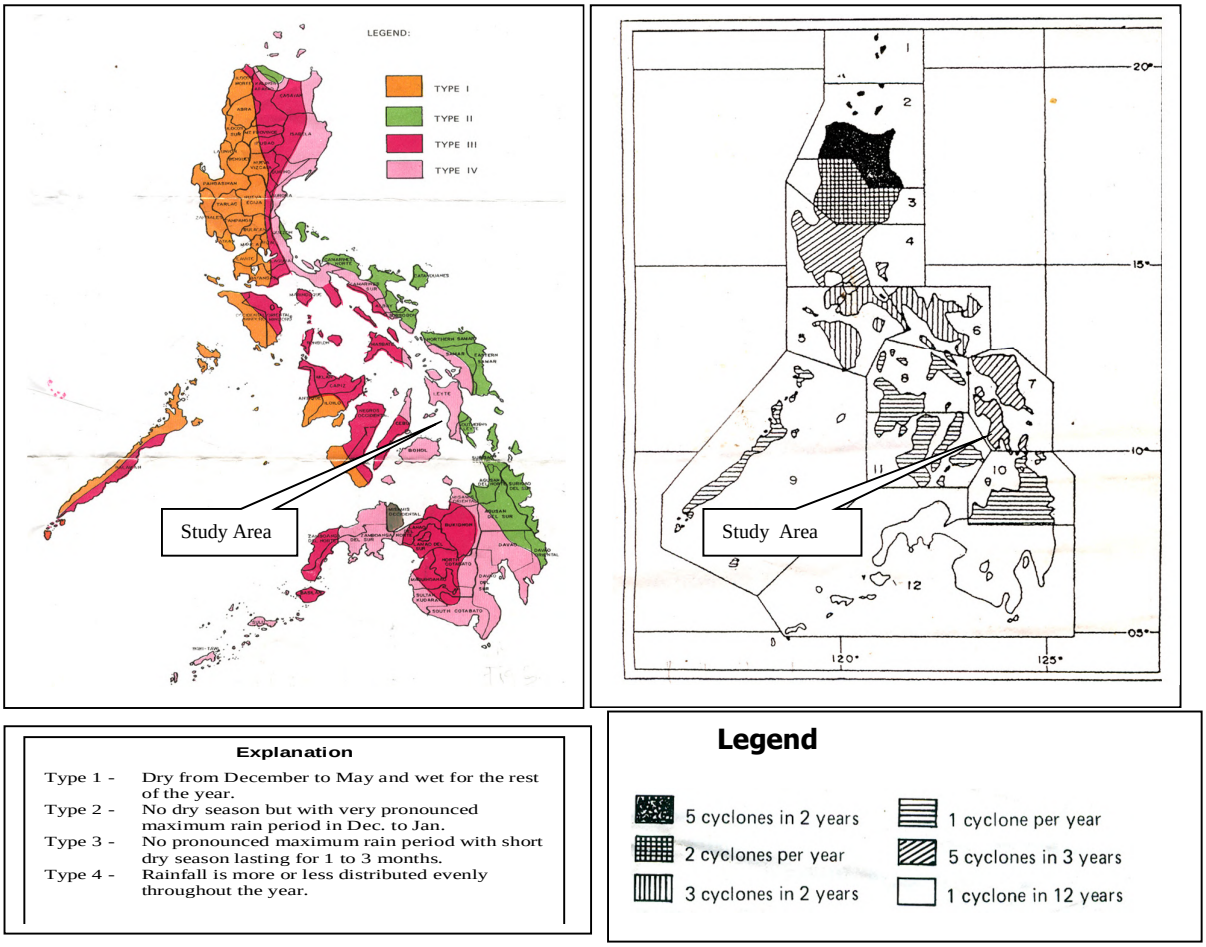

LEGEND:
TYPE I
TYPE II
TYPE III
TYPE IV
Study Area
Study Area
Explanation
Type 1 - Dry from December to May and wet for the rest of the year.
Type 2 - No dry season but with very pronounced maximum rain period in Dec. to Jan.
Type 3 - No pronounced maximum rain period with short dry season lasting for 1 to 3 months.
Type 4 - Rainfall is more or less distributed evenly throughout the year.
Legend
5 cyclones in 2 years
2 cyclones per year
3 cyclones in 2 years
1 cyclone per year
5 cyclones in 3 years
1 cyclone in 12 years

Fig. 2.54 **Corona's System and Typhoon Frequency**

2.3.2 Degradation of Air and Noise Quality

Air and Noise Quality sampling were undertaken for the past three (3) years period, the results are shown below:

Table 2.43 Air Quality Sampling Results, PM10

Monitoring Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2019												
Brgy. Biga	0	0	52.63	20.51	72.73	27.45	66.67	93.33	39.22	70.59	19.61	31.11
Sitio Hag-it	0	0	19.61	10.26	10.26	57.06	30.77	152.94	125.49	124.44	26.67	88.89
Sangi Port Facility	0	0	328.57	207.84	0	186.67	70.18	857.78	62.75	27.45	19.05	31.37
Sigpit Area (Near Hinulawan River)	0	0	248.89	25.64	158.97	39.22	61.54	137.25	71.11	43.14	23.53	48.89
2020												
Brgy. Biga	13.33	46.15	50.98	14.81	14.81	40	102.5	11.76	120	35.9	84.44	26.67

Sitio Hag-it	48.89	101.9	128.8	0	66.67	31.11	53.33	4.44	115.5	40	13.33	46.15
Sangi Port Facility	10.26	31.58	0	0	20	40	50.98	152.9	57.78	102.2	62.75	30.77
Sigpit Area (Near Hinulawan River)	143.59	40	59.65	57.58	33.33	48.89	66.67	102.56	35.9	10.26	90.91	13.33
2021												
Brgy. Biga	0	0	0	122.2	19.05	96.15	0	38.1	12.7	28.57	38.1	19.05
Sitio Hag-it	0	0	0	31.75	50.79	18.18	0	9.52	6.35	6.35	6.35	0
Sangi Port Facility	0	0	0	145.4	95.24	15.87	180.9	41.27	34.92	41.27	9.52	0
Sigpit Area (Near Hinulawan River)	3.07	0	0	31.75	18.18	12.7	38.1	136.5	9.52	15.87	12.7	15.87

Table 2.44 Noise Quality Sampling Results, dBA

2019	Jan	Feb	Mar	Apr	Mar	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Brgy. Biga	54.8	55.2	55.2	56.1	56.8	57.2	53.5	52.6	54.9	56.3	55.7	57.2
Sitio Hag-it	53.6	55.7	55.7	57.7	59.5	56.9	57.4	59.7	54.7	51.3	59.1	56.4
Sigpit Area	72.5	71.8	71.8	68.8	71.2	70.8	67.5	68.7	69.4	63.1	64.4	68.3
Aistrip Area	0	0	0	0	0	69.9	71.3	70.6	72.1	71.7	73.4	72.7
Sangi Port Area	69.7	65.4	69.3	64.2	62.9	62.9	67.9	79.5	68.4	69.2	70.1	72.7
2020												
Brgy. Biga	56.5	59.2	57.2	43	56.3	48.5	61.9	63.1	63.7	50.2	45.8	52.6
Sitio Hag-it	59.4	58.6	59.1	0	46.5	46.9	62.8	63.6	64.5	53.4	51.9	59.4
Sigpit Area	69.8	63.7	68.6	66.2	66.2	64.4	63.5	61.8	68.7	63.9	67.6	71.2
Aistrip Area	71.3	73.2	72.7	0	0	70.6	72.5	71.3	69.3	67.1	69.4	7.1.4
Sangi Port Area	68.3	72.1	0	55.9	61.2	65.1	52	60.1	65.1	63.9	60.1	56.2
2021												
Brgy. Biga	0	53.6	57.6	59.1	56.1	50.3	53.2	54.2	52.3	47.6	48.6	0
Sitio Hag-it	0	51.2	59.1	41.6	45.3	55.2	51.8	52.3	51.6	46.4	46.3	0
Sigpit Area	53.6	53.8	63.6	62.6	59.6	61.3	57	58.5	52.8	49.8	58.6	51.9
Aistrip Area	69.3	70.3	71.4	70.9	68.7	0	69.3	64.1	68.6	69.2	67.4	0
Sangi Port Area	0	56.1	63.2	51.5	63.7	67.3	65.3	56.1	51.9	58.6	54.7	0

Dust is a generic term that describes particulate matters suspended in the atmosphere. It does not make any distinction between the size, shape, and chemical composition of the particulate matters. Fugitive dust refers to dust that is derived from nonpoint sources and does not have an easily defined source. It is formed when particulate matters become airborne due to turbulent action of the wind, mechanical disturbance of fine materials, or release of gaseous emissions laden with particulate matters in an unconfined manner.

Singh (2007) noted that, "[a]ir erosion on the dump is very low compared to water erosion but it will also degrades the air environment… [d]uring the course of water erosion, material gets loosened and makes it susceptible to air erosion.. [t]he primary air pollutant of concern at mining sites is particulate matter. … [o]peration of heavy earth moving machinery in the overburden dumps generate huge amount of dust and the high wind velocity moves the dust particle to the nearby residential areas which creates a lot of problems.

Elaw (__) discussed the general impacts of mining on air quality, as follows,

> Airborne emissions occur during each stage of the mine cycle, but especially during exploration, development, construction, and operational activities. Mining operations mobilize large amounts of

material, and waste piles containing small size particles are easily dispersed by the wind. The largest sources of air pollution in mining operations are:

- Particulate matter transported by the wind as a result of excavations, blasting, transportation of materials, wind erosion (more frequent in open-pit mining), fugitive dust from tailings facilities, stockpiles, waste dumps, and haul roads. Exhaust emissions from mobile sources (cars, trucks, heavy equipment) raise these particulate levels; and

- Gas emissions from the combustion of fuels in stationary and mobile sources, explosions, and mineral processing. Once pollutants enter the atmosphere, they undergo physical and chemical changes before reaching a receptor (Figure 1). These pollutants can cause serious effects to people's health and to the environment.

Large-scale mining has the potential to contribute significantly to air pollution, especially in the operation phase. All activities during ore extraction, processing, handling, and transport depend on equipment, generators, processes, and materials that generate hazardous air pollutants such as particulate matter, heavy metals, carbon monoxide, sulfur dioxide, and nitrogen oxides.

Mobile sources. Mobile sources of air pollutants include heavy vehicles used in excavation operations, cars that transport personnel at the mining site, and trucks that transport mining materials. The level of polluting emissions from these sources depends on the fuel and conditions of the equipment. Even though individual emissions can be relatively small, collectively these emissions can be of real concern. In addition, mobile sources are a major source of particulate matter, carbon monoxide, and volatile organic compounds that contribute significantly to the formation of ground-level ozone.

Stationary sources. The main gaseous emissions are from combustion of fuels in power generation installations, and drying, roasting, and smelting operations. Many producers of precious metals smelt metal on-site, prior to shipping to off-site refineries. Typically, gold and silver is produced in melting/fluxing furnaces that may produce elevated levels of airborne mercury, arsenic, sulfur dioxide, and other metals.

Fugitive emissions. The U.S. Environmental Protection Agency defines 'fugitive emissions' as "those emissions which could not reasonably pass through a stack, chimney, vent or other functionally-equivalent opening."6 Common sources of fugitive emissions include: storage and handling of materials; mine processing; fugitive dust, blasting, construction activities, and roadways associated with mining activities; leach pads, and tailing piles and ponds; and waste rock piles. Sources and characteristics of fugitive emissions dust in mining operations vary in each case, as do their impacts. Impacts are difficult to predict and calculate but should be considered since they could be a significant source of hazardous air pollutants.

Incidental releases of mercury. Mercury is commonly present in gold ore. Although concentrations vary substantially, even within a specific ore deposit, mercury is found in gold ore and associated waste materials. If the content of mercury in a gold ore is 10 mg/ kg, and one million tons of ore is processed at a particular mine (not unusual concentrations), 10 tons of mercury are potentially released to the environment. This is a major source of mercury and should be controlled.

In some gold mining projects, gold-containing ore is crushed and then, if necessary, heated and oxidized in roasters or autoclaves to remove sulfur and carbonaceous material that affects gold recovery. Mercury that is present in the ore is vaporized, particularly in roasters, which are some of the largest sources of mercury emitted to the atmosphere.

Following roasting or autoclaving, the ore is mixed with water and reacted with a cyanide leach solution, where gold and mercury are dissolved and solids removed via filtration. The purified solution is sent to an electrowinning process, where the gold is recovered. In this process, mercury must also be recovered and collected. If not collected by air pollution control devices, this mercury could be released to the atmosphere and impact the environment and public health.

Volatilization of mercury from active heaps and tailings facilities has recently been identified as another substantial source of mercury emitted to the atmosphere. This process should be assessed and controlled. Overall, mercury present in gold ore may be released to the land (in disposed air pollution control wastes and spent ore tailings), to the air (not removed by air pollution control devices, or from tailings or heaps), or in the gold product (i.e., as an impurity).

Noise and vibration. Noise pollution associated with mining may include noise from vehicle engines, loading and unloading of rock into steel dumpers, chutes, power generation, and other sources. Cumulative impacts of shoveling, ripping, drilling, blasting, transport, crushing, grinding, and stock-piling can significantly affect wildlife and nearby residents. Vibrations are associated with many types of equipment used in mining operations, but blasting is considered the major source. Vibration has affected the stability of infrastructures, buildings, and homes of people living near large-scale open-pit mining operations. According to a study commissioned by the European Union in 2000: *"Shocks and vibrations as a result of blasting in connection with mining can lead to noise, dust and collapse of structures in surrounding inhabited areas. The animal life, on which the local population may depend, might also be disturbed"*.

2.3.3 Mitigation Measures

The generation of dust particles can be controlled with the help of following methods:

- Water sprays can be used for control.
- The slope of the haul road in the dump should be optimised for the smooth movement of the dumper and that reduces the dust generation.
- Height of the waste rock dumping should be minimised to reduce the dust generation by wind erosion.
- The dumps should be, wherever feasible, made in such a manner that the impact of predominant wind direction is minimum.
- Wind also entrains dust from overburden dumps and spoil piles (either dry as disposed or the dry portions of impoundments), and other disturbed areas. Sprays from water trucks are often used when the mine is operating.
- During temporary closures, particularly after the active life, stabilisation and reclamation should be aimed in part at reducing fugitive dust emissions. Rock and/or topsoil covers, possibly with vegetative covers, can be effective controls.

The heavy earth moving machinery operations in the overburden handling leads to an increase in the noise levels in the nearby residential areas also. However, at the planning stage the proper selection of the dumpsite can eliminate noise impacts to the residents. During the operation stage the noise level in the overburden dump sites can be minimised by the following methods:

- Minimise the haul road gradient in the dump as far as possible. Since the noise level of the dumper depends upon the power required by the engine. Lower the gradient of the haul road, lower the power needed and hence the noise level can be minimised to some extent.
- Reduce the overburden material falling during the dumping operation

Table 2.45 **Mining Operations Phase Impact Characterization on Air**

Potential Environmental Impact	+/-	Impact Intensity	Extent (impact area)	Duration	Frequency	Likelihood of occurrence	Value of Affected Component	Risk to Human Pop.	Effect of impact
Air quality									
Heavy eqpts/machineries generates dust along access routes and the cleared area for the TSF and WRD	-	Moderate	Primary	Medium term	Continuous	Certain	Low	Low	Flora & fauna,

Exhaust fumes from heavy eqpts will cause localized air pollution	-	Low	Primary	Medium term	occasional	Certain	Low	Low	health
Dust generation from dumping-landfilling activities may be deposited on the surrounding vegetation	-	Mode-rate	Primary	Medium term	Continuous	Certain	Low	Low	Flora & fauna, soil, surface water
Dust affecting settlements	-	Low	Secon-dary	Medium term	occasional	possible	Low	Low	health
Noise									
Noise disturbance of wildlife in surrounding forested areas	-	Low	Primary, Secon-dary	Short Term	Continuous	Certain	Low	Mode-rate	Amenity of wildlife/ disturbance
Noise affecting settlements	-	Low	Secon-dary	Medium term	occasional	possible	Low	Low	Amenity/ disturbance

2.3.4 Environmental Performance/Mitigation and Enhancement Measures for *'air'* component

Assessment for Environmental Performance is primarily based on the project's compliance to the EMP of the Toledo Copper Mine Tailings Disposal Facilities-Sigpit Creek (Interim) & Biga Pit PEPRMP, which was issued ECC No. 070612-290278120, dated Dec. 29, 2006. However, the Sigpit Creek (Interim) TSF project was shelved and no development activities whatsoever were undertaken in the area, thus, there was no implementation of the EMP. While in the Biga Pit area, mitigation and enhancement measures are being put-in-placed to address specific concerns.

The following table exhibits the existing (that will be continued) and proposed mitigation/enhancement measures to address identified environmental impacts on 'AIR' for the Biga TSF and Marcona WRD (existing operations and proposed amendments-new developments).

Table 2.46 **Environmental Performance-Enhancement/Mitigation Measures of Impacts on "AIR"**

Proj Ph	*Envi Component* Potential Impacts	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures	Compliance/ Rejoinder
CONSTRUC-TION	***AIR***. Air pollution	*-To control/minimize the generation of dust form movement of haul trucks & other heavy equipments*	Active areas will be routinely sprayed with water in order to suppress dust. Preservation and planting of trees, vegetation around the TSF an Marcona WRD as buffers/filters	Will be Complied
	AIR. Air pollution	*-to prevent the effects of air pollutants on nearby areas* *-to prevent dusts generation from dumping & wind-induced erosion of dumps*	Appropriate sprinkling in connection with dumping and by immediate rehabilitation of quarry area right after completion	Will be Complied
		Air Quality -to prevent contamination of air due to dust emissions fr vehicles & trucks operating on dirt roads	Water spraying will be conducted on all dirt roads	Will be Complied
	Noise & Vibration	Noise and vibration caused by TSF & WRD activities disturb wildlife		Will be Complied

Proj Ph	*Envi Component* Potential Impacts	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures	Compliance/ Rejoinder
OPERATIONS	**LAND/Soil, air, water** contamination	Accidents, damaged to infrastructure -to prevent soil, air and water contamination, and damaged to infrastructures	-Preventive maintenance program will be implemented on all access roads traversed by the trucks transporting WRD from carmen pit to Marcona. Repair will be undertaken by project proponent if damage is attributed to transport -slow speed in areas with housing & community/barangay Biga faciities	Will be Complied
	WASTE MANAGEMENT Soil, air, water contamination	-To minimize production of industrial waste-scrap metal, empty containers, etc., that will be generated from TSF and WRD	Prepare a waste management plan, that, among others, will provide guidelines & procedures of proper waste management	Will be Complied
		-reusable materials should be reused or recycled to reduce amount of waste generated	-secure storage areas for reusable materials; reusable materials include empty drums, timber, etc. these will be reused by the quarry, sold or given away	Will be Complied
		-to prevent hazardous waste from contaminating soils and water	Hazardous wastes will be stored in a secure area.	Will be Complied
Abandonment Restoration	Land/soil, water contamination	-To return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible -to eliminate significant adverse effects on nearby water resources	- salvage, stockpile and use topsoil for reclamation to the extent feasible; - Slopes should be re-contoured to minimize erosion and runoff; - Planting of native species of vegetation and/or other species of vegetation that are environmentally acceptable, should be undertaken	Will be Complied

2.4 The PEOPLE

2.4.1 Demographic, Socio and Economic Profile

Toledo City is located on the west coast of Cebu island about 50 kilometers from Cebu City. It is bounded by the municipalities of Balamban on the north, Pinamungahan on the south, Naga and Minglanilla on the southeast, Cebu City and Talisay City on the east and Tañon Strait on the west. It can be reached by any mode of land transportation from Cebu City through the Transcentral Highway passing through Balamban or through the Naga-Uling road where travel time is approximately one hour. Toledo City has a seaport where seacrafts regularly plies several times a day to San Carlos City in the neighboring island province of Negros Occidental.

Toledo City has a total of 38 coastal and upland barangays covering an area of approximately 214 square kilometers.

Toledo City Population Profile. ***Toledo*** is a coastal component city in the island province of Cebu.

The city has a land area of 216.28 square kilometers or 83.51 square miles which constitutes 4.37% of Cebu's total area. Its population as determined by the 2020 Census was 207,314. This represented 6.23% of the total population of Cebu province, or 2.57% of the overall population of the Central Visayas region. Based on these figures, the population density is computed at 959 inhabitants per square kilometer or 2,483 inhabitants per square mile.

Toledo City has a population of 207,314, in the year 2020 Thirty six percent (36%) of this population reside in coastal barangays. The combined population of two (2) urban barangays (Poblacion and DAS) accounts 17%. Barangay DAS and Poblacion have population count of 18,948 and 15,572 respectively.

The decline in Toledo city's population growth is being attributed to the shutdown of the operations in 1994. High population growth rates were attained by most barangays in 1970-1990 period. The 1990-2000 period exhibited a steep decline in growth rates of these barangays, as the mines ceased in 1994.

The population of Toledo grew from 12,929 in 1903 to 207,314 in 2020, an increase of 194,385 people over the course of 117 years. The latest census figures in 2020 denote a positive growth rate of 4.22%, or an increase of 36,979 people, from the previous population of 170,335 in 2015.

Table 2.47 **Toledo City Demographic Profile**

Barangay	Population							
	1980	1990	2000	2015	2016	2017	2018	2020
Awihao	2,169	2,849	3,536	4,207	4,075	4,073	4,336	5,062
Bagakay	1,029	1,299	1,426	2,485	1,801	1,898	2,561	2,298
Bato	3,772	4,752	6,319	8,173	8,086	8,574	8,423	9,041
Biga	1,485	1,247	2,283	3,327	2,213	1,954	3,429	3,983
Bulongan	854	1,632	2,212	2,647	2,515	2,492	2,728	2,624
Bunga	1,293	2,461	2,557	3,868	3,633	4,054	3,986	5,361
Cabitoonan	2,023	2,444	3,345	4,154	4,031	4,137	4,281	5,483
Calongcalong	568	1,195	1,118	1,535	1,414	1,491	1,582	1,525
Cambang-ug	1,535	2,691	3,414	3,668	3,769	3,667	3,780	4,125
Camp 8	784	1,127	1,427	2,529	1,893	2,045	2,606	2,237
Canlumampao	1,894	2,598	2,882	4,170	3,756	4,020	4,298	5,029
Cantabaco	3,418	5,633	5,665	7,304	7,076	7,408	7,527	9,426
Capitan Claudio	2,175	2,539	3,908	4,311	4,133	3,902	4,443	5,069
Carmen	1,732	2,155	2,642	3,858	3,737	4,159	3,976	4,857
Daanglungsod	2,673	2,833	2,855	2,933	2,987	2,798	3,023	3,786

DA Soriano (Lutopan)	16,713	21,592	18,859	12,764	16,343	13,021	13,154	18,948
Dumlog	1,560	2,045	2,669	5,288	4,428	5,258	5,450	6,594
Ibo	1,791	2,492	2,796	3,699	3,840	4,217	3,812	4,727
Ilihan	1,657	2,134	2,787	3,206	3,565	3,779	3,304	4,422
Landahan	1,111	1,254	1,439	2,183	1,930	2,095	2,250	1,776
Loay	597	821	965	1,501	1,548	1,815	1,547	1,807
Luray II	1,028	2,708	3,618	4,640	4,681	4,995	4,782	4,740
(Magdugo)	2,213	3,089	4,265	6,279	5,935	6,559	6,471	8,581
Gen. Climaco (Malubog)	2,280	4,103	5,372	6,337	5,885	5,693	6,531	6,356
Matab-ang	4,424	4,939	6,706	9,868	9,725	10,948	10,170	11,538
Media Once	3,144	4,322	5,337	7,128	6,905	7,363	7,346	9,298
Pangamihan	1,383	1,519	1,543	2,333	1,762	1,751	2,404	2,492
Poblacion	7,940	10,963	12,823	13,383	14,381	14,129	13,792	15,572
Poog	2,450	4,032	4,898	5,989	6,039	6,277	6,172	7,082
Putingbato	1,297	1,072	1,358	1,413	1,544	1,529	1,456	1,693
Sagay	1,059	882	1,238	1,145	1,710	1,884	1,180	1,591
Sam-ang	887	1,196	1,553	1,719	1,759	1,737	1,772	2,264
Sangi	2,348	3,649	3,553	4,201	4,087	4,081	4,330	5,376
Santo Niño (Mainggit)	1,800	2,320	4,260	5,316	4,604	4,412	5,479	7,049
Subayon	621	797	851	1,432	1,228	1,381	1,476	1,007
Talavera	3,124	3,427	4,916	6,041	5,300	5,072	6,226	7,731
Tungkay	882	1,426	1,463	1,173	1,568	4,087	1,209	1,394
Tubod	1,380	1,717	2,316	4,128	3,549	1,494	4,254	5,370
Total		121,944	141,174		167,435	170,249	175,546	207,314

Barangay Profile. While the population of all 35 barangays registered an increasing trend in population growth in 2000, barangays Don Andres Soriano (Lutopan), Sangi and Calongcalong experienced otherwise. Sangi and Calongcalong decreased its population by less than one hundred persons each, while DAS decreased by more than two thousand. Expectedly this is one of the effects of the closure of Atlas Mining during the period. During the census of NCSO in 2000, the five most densely populated barangays are Don Andres Soriano (3,507 persons/sq.km), Poblacion, Matab-ang and Bato. Despite a significant decrease in the population growth rate of barangay Don Andres Soriano from 1990-2000 it still holds on as the most densely populated barangay of Toledo City. However the barangays that would most likely be affected by the project only registered a population density of less than 500 persons per sq. kilometer.

Table 2.48 Population Density, by Barangay

Barangay	Land Area (hectares)	Population			Population Density		
		2000	2015	2020	2000	2015	2020
Awihao	209	3,536	4,207	5,062	17	20	24
Bagakay	813	1,426	2,485	2,298	2	3	3
Bato	357	6,319	8,173	9,041	18	23	25
Biga	1,017	2,283	3,327	3,983	2	3	4
Bulongan	725	2,212	2,647	2,624	3	4	4
Bunga	227	2,557	3,868	5,361	11	17	24
Cabitoonan	528	3,345	4,154	5,483	6	8	10
Calongcalong	56	1,118	1,535	1,525	20	27	27
Cambang-ug	805	3,414	3,668	4,125	4	5	5
Camp 8	291	1,427	2,529	2,237	5	9	8
Canlumampao	677	2,882	4,170	5,029	4	6	7
Cantabaco	1,014	5,665	7,304	9,426	6	7	9
Capitan Claudio	1,538	3,908	4,311	5,069	3	3	3
Carmen	407	2,642	3,858	4,857	6	9	12

Barangay	Land Area (hectares)	Population			Population Density		
		2000	2015	2020	2000	2015	2020
Daanglungsod	119	2,855	2,933	3,786	24	25	32
DA Soriano (Lutopan)	1,760	18,859	12,764	18,948	11	7	11
Dumlog	216	2,669	5,288	6,594	12	24	31
Ibo	311	2,796	3,699	4,727	9	12	15
Ilihan	277	2,787	3,206	4,422	10	12	16
Landahan	417	1,439	2,183	1,776	3	5	4
Loay	795	965	1,501	1,807	1	2	2
Luray II	155	3,618	4,640	4,740	23	30	31
Juan Climaco, Sr. (Magdugo)	514	4,265	6,279	8,581	8	12	17
Gen. Climaco (Malubog)	1,106	5,372	6,337	6,356	5	6	6
Matab-ang	1,111	6,706	9,868	11,538	6	9	10
Media Once	920	5,337	7,128	9,298	6	8	10
Pangamihan	853	1,543	2,333	2,492	2	3	3
Poblacion	303	12,823	13,383	15,572	42	44	51
Poog	569	4,898	5,989	7,082	9	11	12
Putingbato	590	1,358	1,413	1,693	2	2	3
Sagay	152	1,238	1,145	1,591	8	8	10
Sam-ang	393	1,553	1,719	2,264	4	4	6
Sangi	82	3,553	4,201	5,376	43	51	66
Santo Niño (Mainggit)	486	4,260	5,316	7,049	9	11	15
Subayon	248	851	1,432	1,007	3	6	4
Talavera	647	4,916	6,041	7,731	8	9	12
Tungkay	607	1,463	1,173	1,394	2	2	2
Tubod	191	2,316	4,128	5,370	12	22	28
Total	21,486	141,174	170,335	207,314	657	8	10

Table 2.49. **Total Population by Age Group and Sex-Toledo City 2015**

Age Bracket	Both Sexes	Male	Female	Age Bracket	Both Sexes	Male	Female
All Ages	170,335	87,349	82,986	55 - 59	5,806	2,906	2,900
Under 1	4,176	2,137	2,039	60 - 64	4,609	2,235	2,374
1 - 4	16,450	8,540	7,910	65 - 69	3,169	1,487	1,682
5 - 9	20,268	10,555	9,713	70 - 74	2,139	960	1,179
10 - 14	18,648	9,625	9,023	75 - 79	1,361	624	737
15 - 19	17,119	8,827	8,292	80 years & over	916	368	548
20 - 24	15,852	8,147	7,705	0 - 4	20,626	10,677	9,949
25 - 29	13,875	7,243	6,632	0 - 14	59,542	30,857	28,685
30 - 34	11,868	6,220	5,648	15 - 64	103,208	53,053	50,155
35 - 39	10,532	5,506	5,026	18 years & over	100,106	50,940	49,166
40 - 44	9,065	4,649	4,416	60 years & over	12,194	5,674	6,520
45 - 49	7,752	3,935	3,817	65 years & over	7,585	3,439	4,146
50 - 54	6,730	3,385	3,345				

Table 2.50 Literacy of the Household Population 10 Years Old and Over by Age Group, Sex, Toledo City: 2015

Age Group	HH Pop. 10 years Old & Over			Literate		
	Both Sexes	Male	Female	Both Sexes	Male	Female
Total	128,845	65,650	63,195	126,768	64,650	62,118
10 - 14	18,588	9,590	8,998	18,494	9,534	8,960
15 - 19	17,054	8,788	8,266	16,967	8,723	8,244
20 - 24	15,779	8,084	7,695	15,673	8,013	7,660
25 - 29	13,791	7,169	6,622	13,715	7,129	6,586
30 - 34	11,788	6,151	5,637	11,694	6,094	5,600
35 - 39	10,462	5,443	5,019	10,336	5,375	4,961
40 - 44	9,000	4,598	4,402	8,876	4,534	4,342
45 - 49	7,713	3,904	3,809	7,555	3,827	3,728
50 - 54	6,703	3,363	3,340	6,540	3,281	3,259
55 - 59	5,794	2,897	2,897	5,619	2,813	2,806
60 - 64	4,601	2,230	2,371	4,446	2,165	2,281
65 years old & over	7,572	3,433	4,139	6,853	3,162	3,691

TABLE 2.51 Gainful Workers 15 Years Old and Over by Major Occupation Group, Age Group, Sex, in Toledo Cty: 2015

Sex, Major Occupation Group	Gainful workers 15 Yrs & over	AGE Group										
		15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65 +
Both Sexes	59,117	3,203	8,012	8,487	7,616	6,930	6,062	5,221	4,627	3,779	2,449	2,731
Managers	3,991	94	254	379	490	519	490	429	417	383	272	264
Professionals	2,870	6	445	593	516	409	348	198	170	103	65	17
Technicians and Associate Professionals	2,639	57	300	431	386	346	311	263	223	183	88	51
Clerical Support Workers	2,734	77	653	623	411	291	206	165	131	102	47	28
Service and Sales Workers	7,798	634	1,331	1,097	872	784	745	686	629	461	290	269
Skilled Agricultural Forestry and Fishery Workers	7,002	133	300	426	426	506	544	754	805	884	804	1,420
Craft and Related Trades Workers	14,400	434	1,949	2,485	2,218	1,925	1,624	1,347	1,075	758	355	230
Plant and Machine Operators and Assemblers	5,603	124	563	802	909	889	754	522	435	339	182	84
Elementary Occupations	11,996	1,608	2,212	1,642	1,380	1,257	1,035	854	737	561	343	367
Armed Forces Occupations	20	-	1	6	1	1	2	-	4	4	1	-
Other Occupation Not Elsewhere Classified	-	-	-	-	-	-	-	-	-	-	-	-
Not Reported	64	36	4	3	7	3	3	3	1	1	2	1
Male	42,046	2,033	5,517	6,283	5,745	5,163	4,419	3,757	3,231	2,633	1,545	1,720
Managers	1,982	73	166	232	279	248	228	195	186	160	106	109
Professionals	1,014	2	132	217	167	135	132	65	72	51	33	8
Technicians and Associate Professionals	1,751	23	168	273	260	239	227	175	154	141	56	35
Clerical Support Workers	1,273	38	289	277	193	124	111	94	61	52	18	16
Service and Sales Workers	3,478	236	580	573	452	394	338	296	242	200	83	84
Skilled Agricultural Forestry and Fishery Workers	5,529	122	270	374	371	411	423	590	634	685	611	1,038

Craft and Related Trades Workers	13,507	371	1,760	2,347	2,127	1,841	1,547	1,284	1,031	712	309	178
Plant and Machine Operators and Assemblers	5,298	95	455	721	877	870	744	513	425	336	182	80
Elementary Occupations	8,161	1,050	1,694	1,262	1,016	898	666	544	423	292	145	171
Armed Forces Occupations	18	-	1	5	1	1	2	-	3	4	1	-
Other Occupation Not Elsewhere Classified	-	-	-	-	-	-	-	-	-	-	-	-
Not Reported	35	23	2	2	2	2	1	1	-	-	1	1
Female	17,071	1,170	2,495	2,204	1,871	1,767	1,643	1,464	1,396	1,146	904	1,011
Managers	2,009	21	88	147	211	271	262	234	231	223	166	155
Professionals	1,856	4	313	376	349	274	216	133	98	52	32	9
Technicians and Associate Professionals	888	34	132	158	126	107	84	88	69	42	32	16
Clerical Support Workers	1,461	39	364	346	218	167	95	71	70	50	29	12
Service and Sales Workers	4,320	398	751	524	420	390	407	390	387	261	207	185
Skilled Agricultural Forestry and Fishery Workers	1,473	11	30	52	55	95	121	164	171	199	193	382
Craft and Related Trades Workers	893	63	189	138	91	84	77	63	44	46	46	52
Plant and Machine Operators and Assemblers	305	29	108	81	32	19	10	9	10	3	-	4
Elementary Occupations	3,835	558	518	380	364	359	369	310	314	269	198	196
Armed Forces Occupations	2	-	-	1	-	-	-	-	1	-	-	-
Other Occupation Not Elsewhere Classified	-	-	-	-	-	-	-	-	-	-	-	-
Not Reported	29	13	2	1	5	1	2	2	1	1	1	-

ECONOMIC ACTIVITIES

The economy of Toledo City revolves around land-based agriculture including livestock and poultry, fishery, mining and commerce.

Agriculture. Toledo City has an agriculture-based economy. Crops grown are coconut, banana and corn. While agriculture dominates the economy, productivity is constrained by poor farming systems resulting to low yield under rainfed conditions, poor soil and lack of access to appropriate technologies. Most lands particularly in the rural areas are tenant-cultivated at a sharing system of 1:3 where one share goes to the landowner while 3 shares to the tenant who spends for all production inputs. Livestock and poultry are raised in backyards and sold to augment family income. Corn is the staple crop and is often raised for household consumption.

Mining. Toledo City is known for its minerals and other natural resources. For more than 3 decades, the economy of Toledo City revolved around copper mining when the Atlas Consolidated Mining and Development Corporation (ACMDC) was actively operating. The copper ore reserve in the area is known to be over half a billion metric tons and could last for more than a century with full operations.

Coal mining is also one of the small-scale industries that has become a livelihood for many small-time operators. Operation is being done manually using hand tools. Limestone quarrying and sand and

gravel extraction are mostly operated from medium to small-scale. These small-scale industries are supporting the livelihood of many families who had been affected by the closure of ADMDC operation.

Commerce and Trade. Toledo City's strategic location makes it the center of commerce and trade in the west coast area. Fishery and agricultural products from the southern and northern towns find their way in the markets of Toledo City. Likewise, Toledo City also hosts products ranging from electronic and farm implements to textiles. There are two public markets situated at the Poblacion and at barangay DAS where trading is usually done. However there are also a number of privately run neighborhood markets that often offer better service than the government run facilities.

HEALTH PROFILE. With the increasing population, the number of morbitiy and mortality cases correspondingly increases. The top two (top) morbidity cases from 2015-2017 has been consistently been animal bites and URTI, while hypertension and pneumonia top billed the mortality case in the same period.

Table 2.52 General Health Situation for the last 5-Yers

HEALTH INDICATOR	YEAR				
	2013	2014	2015	2016	2017
Population	159,757	160,501	165,663	167,435	170,249
Fertility					
Crude Birth Rates (CBR)	22.73	25.84	13.22	12.75	13.63
Morbidity					
General Medical	25,1511	19,557	54,827	25,894	27,239
Consultative Rate	15.74%	12.18%	33.09%	15.46%	16%
Mortality Rate					
Crude Death Rate	5.53	5.50	4.06	4.01	4.02
Infant Mortality Rate	2.48	2.89	7.05	0.70	2.89
Young Child Mortality Rate	14.87	8.43	8.95	1.5	8.43
Maternal Mortality rate	55.06	120.57	0	0.05	0

Table 2.53 **Leading causes of Morbidity 2015-2017 Toledo City**

2015		**2016**		**2017**	
CAUSES	NO.	CAUSES	NO.	CAUSES	NO.
Animal Bite	1909	Animal Bite	2392	Animal Bite	2673
URTI	1039	URTI	1416	URTI	1182
Hypertension	706	Wound (all types)	649	Cough	596
Influenza	449	Cough	613	Wound (all types)	476
TB (all form)	205	Fever	510	TB (all forms)	433
Asthma	143	TB (all forms)	374	Fever	346
Dengue	137	Hypertension	237	Hypertension	311
Pneumonia	121	Boil	81	Boil	95
Age	59	AGE	69	Age	43
Bronchitis	18	SVI	47	SVI	14
TOTAL	4786	TOTAL	6438	TOTAL	6169

Mortality. Hypertension leads as the most common causes of deaths along with Pneumonia, Myocardial Infarction. Other causes are Diabetes Mellitus, Cardiovascular Diseases, Cancer, Peptic Ulcer, Bronchial Asthma and PTB. Among infants, the leading causes of deaths are pneumonia, acute respiratory distress syndrome. Diarrhea, still births, congenital heart disease, sepsis neonatorum and prematurity.

Table 2.54 **Leading causes of Mortality 2015-2017 Toledo City**

2015		2016		2017	
CAUSES	NO.	CAUSES	NO.	CAUSES	NO.
Hypertension	134	Hypertension	76	Hypertension	121
CHF	77	Pneumonia	72	Pneumonia	115
Cardio-Resp Arrest	29	Myocardial Infarction	55	Myocardial Infarction	102
Pneumonia	82	Cancer (all forms)	45	Heart Failure	31
Myocardial Infarction	75	CHF	42	Diabetes Mellitus	22
Broncihites Asthma	20	Diabetes Melitus	23	Disorder of the Brain	22
Kidney Failure	24	Sepsis	22	Shock (not classified)	18
Sepsis	31	Chronic Kidney Ds	18	Renla Failure	18
Hepatoma	21	Hypovolemic shock	9	Cardiac Arrest	16
CVA	25		8	Myocardial Infarction	13
TOTAL	518	TOTAL	370	TOTAL	478

Health Services and Facilities. Toledo City has one primary hospital, a social hygiene clinic, a health center, 26 barangay health stations, 7 private clinics and 5 dental clinics. Providing medical and health services is a team from the City Health Unit of Toledo which is composed of 7 medical doctors, 3 nurses, 5 dentists, 14 midwives and a host of assistants and support service team to include medical technologists, dental aides, BNS, Sanitary Inspector and Trained birth attendants. With the present population, one medical doctor serves a population is 20,167 people.

Table2.55 **Health Personnel, Toledo City, 2004**

Personnel	2004		2017	
	No.	Personnel: Pop. Ratio	No.	Personnel: Pop. Ratio
Doctor	7	1:20,167	2	1:86,451
Nurse	3	1:17,512	3	1:57,634
Medical Technologist	2	1:70,587	2	1:86,451
Dentist	5	1:28,234	5	1:34,580
Midwife	14	1:10,083	14	1:12,350
Sanitary Inspector	12	1:11,764	9	1:19211
Dental aides	4	1:35,293	4	
Nursing attendant	14	1:10,083		
BNS	44	1:3,208	46	
Trained Birth Attendants	71	1:1,988		
CHW			38	
Non-Technical			4	

Health Care Program of the Company

Carmen Copper takes care of its communities. It continually raised their living conditions by providing them with health facilities and services, medicines, health education and preventive measures, training of health paraprofessionals, maternal-child health care and family planning, access to clean and potable water, and provision of waste and among others.

To date, Carmen Copper has built 6 health facilities and birthing centers, has served more than 33,741 patients through its Doctor to the Barangay program, has donated 23 ambulances, and has feed more than 488,100 children under the school-based feeding program since 2015.

These, and many more health-related projects like the deployment of volunteer nurses to the communities, construction of birthing centers, bloodletting, and Operation Tuli, among others, were implemented.

2.4.2 Displacement of Settlers

The proposed modifications on Carcon facility and expansion of the Airstrip WRD (including the introduction of Crushing facility) will not cause displacement of settlers nor it will affect/displaced any households and housing/dwelling units that will be displaced.

The Marcona WRD project that was already issued an ECC, but has yet to be implemented, has marginal farmers cultivating seasonal crops in some patches of land within the proposed Marcona WRD project that will be displaced when the project will be implemented.

The Comrel has conducted an inventory of farm/cultivated plots or occupation that will be affected by the development of the Marcona WRD and Biga Pit TSF enhancement. CCC has to directly deal with the concerned and negotiate terms of compensation and relocation. It should be noted that the Marcona WRD is within the property of the ACMDC/CCC thus, the farmers cultivating crops in the area has already an understanding with the management that should the time comes for the utilization of the area, the farmer(s) has to vacate the area.

During the public scoping and hearing, CCC (through the Comrel) indicated that those farming activities and huts/shed that will be affected in the Marcona WRD project site, will be paid two Thousand Pesos (2,000 Php) and eighty (80) wood pieces for rebuilding of their huts/shed in other areas outside of the Marcona WRD and its immediate surroundings. CCC has also provided 4.1M Php for the relocation of Marcona Community houses, based on the following estimates:

Table 2.56 Housing/Community Houses Cost

Item	Particular	Unit	Quantity	**Direct Cost**	**Indirect Cost**	%
				Amount	Amount	
1.0	**Material Cost**					
1.1	Community Houses	lot	1.00	4,160,000.00	4,160,000.00	100.00
Total Direct Cost				**4,160,000.00**	**4,160,000.00**	**100.00**
	Contingency	0%		-	Mark-up Factor	1.00
	Overhead & Miscellaneous	0%		-		
	Contractor's Profit	0%		-		
Total Estimated Cost				**4,160,000.00**		

CCC has also budgeted/set-aside P699,996.00 for assistance to relocation 33 units Farmer's huts. It was also agreed that farming/cultivation activities within the area will not be disrupted until such time that the Marcona WRD development will be started. The farmers will be given notices and ample time to harvest their crops.

2.4.3 In-Migration

It is not expected that the development of the Marcona WRD, expansion of the Airstrip WRD and other additional activities within the TCM will result in the increase of in-migration during the construction and operation stages of these facilities.

2.4.4 Cultural/Lifestyle Change (especially on Indigenous People, if any)

There are no Indigenous People living/residing within the TCM nor in the entire City of Toledo.

2.4.5 Impacts on Physical Cultural Resources

There are no physical cultural resources within the TCM nor in its immediate vicinity.

2.4.6 Threat to Delivery of Basic Services/Resource Competition

- Damage to roads. Increase in transportation requirement and volume of traffic (especially the haul route from the mine pits to the Marcona WRD) can result to traffic disruption and inconvenience to Biga residents which also uses same road.. Fielding of traffic aide to provide assistance/directions (e.g. stop/go when there are heavy machineries passing/working) and regular maintenance/repair works for road damages.

- Loss of livelihood. With the prohibition and non-allowance of farming activities in the Marcona WRD project area, the affected farmers can no longer earned income from the land they tilled – they have to look for and transfer to other areas that they can continue this source of livelihood and income. Likewise, labor requirement can also be sourced out from among displaced residents and the locals. Trainings for livelihood opportunities for women, the youth and the underprivileged sector can be embarked.

- Disruption of social systems. This condition may be transitory as this would most likely happen during the construction stage and would phase out when the structures are completed which would take only a couple of months. However, Community organizers or social workers can be fielded to buffer the situation.

- Competition in the access and use of resources and services. As part of its social responsibility, CCC has undertaken the provision of potable water to a number of households whose water source are affected by the project.

Energy and water management. We consistently monitor our energy utilization from fuel consumed by the company to electricity use. We need to focus more on opportunity for conservation and energy efficiency in our operation such as more efficient production. As part of company's commitment to its host communities, free electricity to some vital public facilities and school are continuously provided. For water resource conservation and management. We minimize our withdrawal from fresh water sources through our conservation and recycling efforts. Preservation of water quality of our water sources, meeting the standards for contamination-free water sources since 2018. Annually, approximately 1.7Million cubic meters of water supplied to our communities through Toledo City Water District (TCDW).

Most of the water supply requirements of the Toledo Copper mines comes from the Carcon which needed one (1) gallon of water to process 2.27 MTPD of ore per minute (For example, at 42,000 MTPD, Carcon will require about 18,500 gallons per minute (gpm) of water). About half of this requirement will be used water reclaimed from the copper and tailings thickeners. The other half of the requirement will be fresh water provided by the Malubog Reservoir located about three kilometers northeast of Carcon. Other uses of water are for domestic, washing and irrigation purposes. The company operates its own water treatment facility that supplies the domestic needs of the Atlas community.

2.4.7 Threat to Public Health and Safety

Physical stability of mine is an important long-term environmental concern because of the amounts of materials involved and the consequences of slope failure. Mining operations can result in the formation of slopes composed mainly of overburden (earth, rock, tailings, other mine wastes, or combinations of materials). Landslides in the hilly terrains due to steepening of slopes during opencast mining operations are quite common. Other than sheer physical impacts, catastrophic slope failure can affect the environment or human health when toxic materials are released from the failure especially if it occurs in an area where such a release results in a direct pathway to receptors. Ensuring physical stability requires adequate pre-mining design of overburden waste management units and may require long-term maintenance.

Slope failure results from exceeding the internal mass strength of the overburden materials composing the slope. This occurs when the slope angle is increased to a point where the internal mass strength can

no longer withstand the excess load resulting from over steepening or overloading of the slope. When the driving forces associated with over steepening exceed the internal resisting forces, the slope fails and the materials move to a more stable position.

There will be several activities that will expose the workers as well as the local communities to environmental hazards during the construction stage. Clearing, grubbing and excavation will be done by heavy equipments and by manual laborers. The equipment, vehicles and machines will produce air pollution from the burning of fuel. The excavation of the soil would also produce dust in large amount. Incidence of occupational accidents, noise, heat and other stressors including air pollution and dust are the most common problems encountered during construction and pre-construction.

During the operation phase of the Carcon facility, expanded Airstrip WRD (with its crushing facility), including that of the Marcona, Biga Pit TSF, occupational hazards and accidents shall be prevented.

Most common causes of morbidity among residents in the area is respiratory related. These are followed by gastrointestinal cases, which could possibly be due unsanitary living conditions and poor facilities.

HEALTH ENVIRONMENT IMPACT MITIGATION

- Physical hazards. Protection of workers from physical hazards is the primary concern of CCC. Workers should wear protective covering. Proper signages should also be placed in critical areas to promote caution to visitors. The work area should be provided with a mobile primary health service for immediate response to emergencies and for fast access to hospitals. Should construction work happen during the dry season, an increase in wind blown dust can be avoided by sprinkling water on dry and loose soil.
- Health of workers and local communities. Regular check up of TCM workers are made available. The Atlas Hospital also provides health and medical services to the surrounding communities.
- Poor sanitation, facilities and services. Sanitary toilets be provided at the workplace, even if it is only temporary to avoid unsanitary environment.

Carmen Copper takes care of its communities. It continually raised their living conditions by providing them with health facilities and services , medicines, health education and preventive measures, training of health paraprofessionals, maternal-child health care and family planning, establishment of nutrition and immunization programs, access to clean potable water, and provision of waste and sewage disposal facilities , among others.

These, and many more health-related projects like the deployment of volunteer nurses to be communities, construction of birthing centers, medical missions in partnership with SM Foundation Inc., and Bloodletting in cooperation with the Department of Health (DOH) Region VII Blood Center and the Philippine Red Cross Eastern Visayas Regional Blood Center- Cebu Chapter

2.4.8 Generation of Local Benefits from the Project

The social impacts of mining activities are mixed. Positive impacts, like income generation for those working directly with the Toledo Copper Mines operations and people who provide services or goods to the project. Workers could use their earnings to fund education for their children and put-up businesses like small stores. Non-mining workers may also profit from the quarry establishment in the area by selling goods and services to the project.

Beyond compliance, Carmen Copper is committed to building responsible, self-reliant and sustainable communities. In order to achieve this, the Company adopted the Social Investigation and Participatory Situation Analysis (PSA) approach, a community-driven development strategy, wherein communities take an active part in decision-making processes relative to projects identification, prioritization and planning.

Its focus areas are (1) quality and inclusive education; (2) quality healthcare services, (3) skills and enterprise development or livelihood, (4) preservation of cultural heritage, and (5) disaster resilience and rehabilitation. It also develops mining technology and geosciences, and intensifies its Information, Education and Communication (IEC) Program. Members of the host and neighboring communities with skills necessary in the operation of the company are priority during hiring.

The company are always been geared to thrive lasting impact to our host and neighboring communities. Maintaining good relations with our communities enable us to continue our operations. We remained an active partner of the local government in responding to our host communities since the start of pandemic and in the aftermath of the super typhoon Odette.

Contribution to nation building through payment of taxes both National and Local. Payment of National taxes, (Income tax, Excise tax, Custom Duties and Fees, VAT, Documentary Stamp Tax, Withholding Tax in Payroll, Withholding Tax on claim and Surface Owners, Withholding Tax on Interest Payments, Withholding Tax on Creditors and Other National taxes)

For local taxes, Carmen Copper Corporation (CCC) are consistent Top Taxpayer for Real Property Tax, local business tax and others in Toledo City. We serve as the bridge of our host communities to access social progress that help improve quality of life.

2.4.9 Traffic Congestion

The CCC mine complex is served and crisscrossed by a network of primary, feeder roads, and mine haul roads that connects all operating points and facility sites needed for its mining activities. A combine average of 468 units of haul trucks from the company and service contractors were deploy daily for the hauling of ore and waste materials, including the hauling of copper concentrates from mine to port area with an average of 18 units of dump trucks per day.

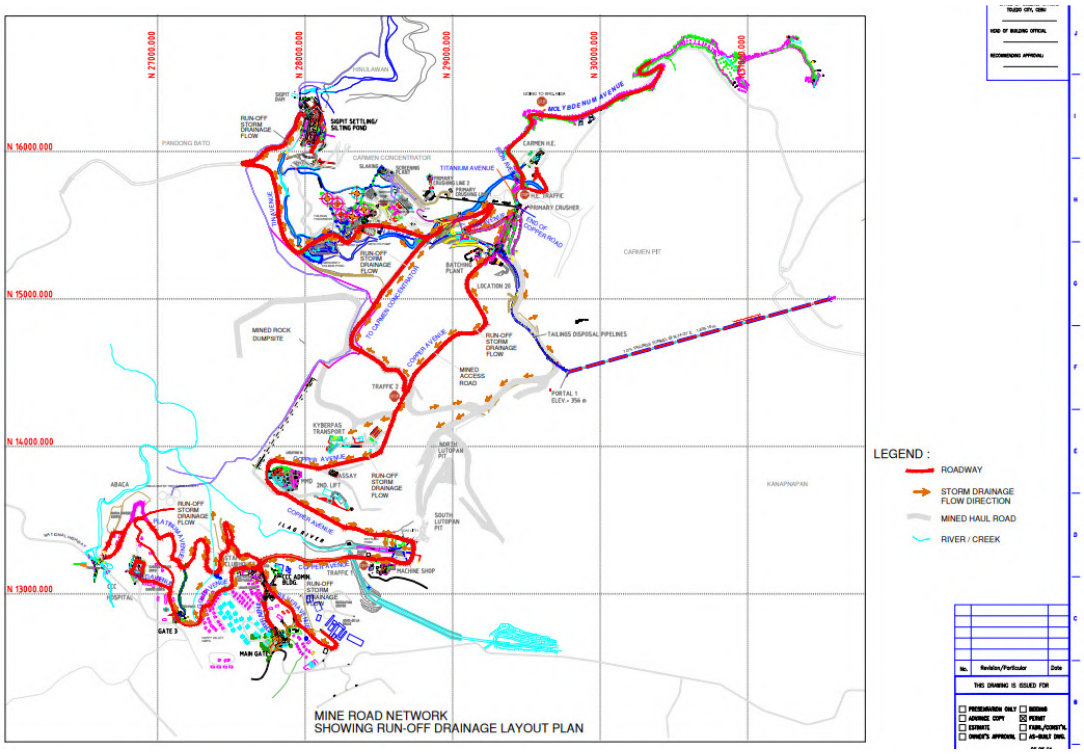


Figure 2.55 Mine Road Network

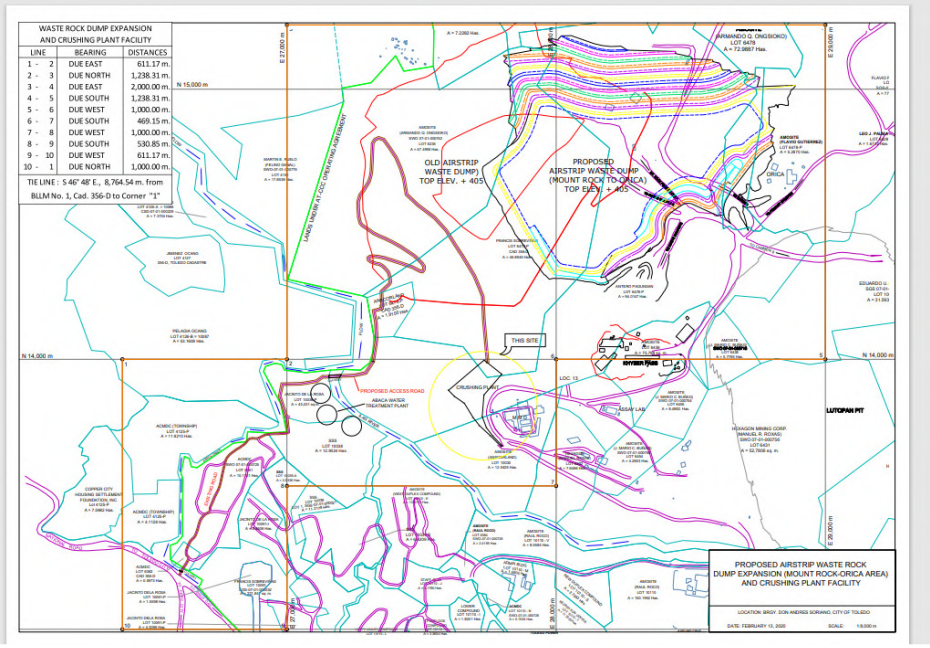

WASTE ROCK DUMP EXPANSION AND CRUSHING PLANT FACILITY
LINE | BEARING | DISTANCES
1 - 2 | DUE EAST | 611.17 m.
2 - 3 | DUE NORTH | 1,238.31 m.
3 - 4 | DUE EAST | 2,000.00 m.
4 - 5 | DUE SOUTH | 1,238.31 m.
5 - 6 | DUE WEST | 1,000.00 m.
6 - 7 | DUE SOUTH | 469.15 m.
7 - 8 | DUE WEST | 1,000.00 m.
8 - 9 | DUE SOUTH | 530.85 m.
9 - 10 | DUE WEST | 611.17 m.
10 - 1 | DUE NORTH | 1,000.00 m.
TIE LINE : S 46° 48' E., 8,764.54 m. from BLLM No. 1, Cad. 356-D to Corner "1"
OLD AIRSTRIP WASTE DUMP) TOP ELEV. + 405
PROPOSED AIRSTRIP WASTE DUMP (MOUNT ROCK TO ORICA) TOP ELEV. + 405
PROPOSED ACCESS ROAD
CRUSHING PLANT
LUTOPAN PIT
PROPOSED AIRSTRIP WASTE ROCK DUMP EXPANSION (MOUNT ROCK-ORICA AREA) AND CRUSHING PLANT FACILITY

Figure 2.56 Access Road to Airstrip WRD/Crushing Facility

The flow of the traffic coming from Lusong mining area will be controlled at the Danawan Marcona junction where in the traffic lights will be installed similar to the Airstrip waste dump junction, Biga HE junction and Northwest Biga dump junction. Dumptrucks route from Lusong haul road (in yellow color line) towards the proposed traffic lights. It will also served as a guide for the community from Brgy Biga and Brgy Danawan to pass through of the said area.

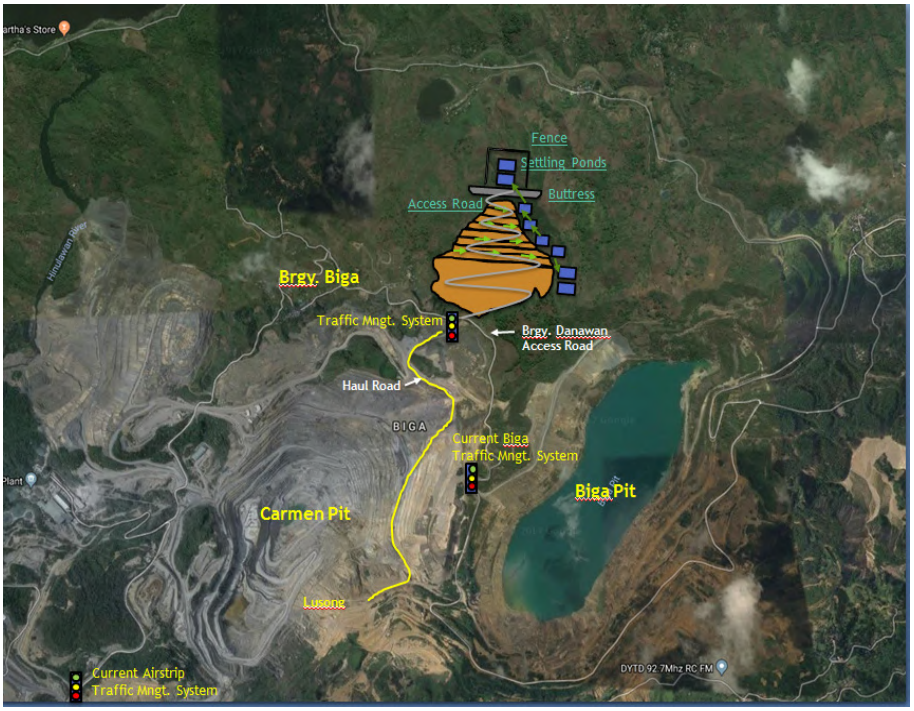


Figure 2.57 Traffic Management Plan/Scheme for the Marcona WRD area

2.4.10 Perception Survey Results

The impact barangays served as a stratum and systematic random sampling was then conducted to determine the different sectors per barangay. The survey team distributed the questionnaire that will measure communities' perception, level of awareness and source of information's, effectiveness in the implementation of Health Services, Education, Livelihood and Public Infrastructures under the Social Development and Management Programs (SDMP) as well as the propose expansion of facilities. These questionnaires were answered individually by the respondents but they were guided and supervised accordingly by the team.

Table 2.57 Result of Perception Survey per Barangay. Positive (P); Negative (N)

PERPCETION OF RESIDENTS TO CCC	BARANGAYS																			
	LOAY		DAS		MEDIA ONCE		BIGA		CANTA-BACO		POOG		BAGA -CAY		GEN. CLIMACO		CAMPO 8		DAAN LUNGSOD	
	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N
Perception of residents and other barangays within and surrounding the Atlas Mines																				
A. Proximity to our source of livelihood	1	-	3	-	1	-	3	-	3	-	6	-	2	-	4	-	2	-	4	-
B. Adequate supply of potable water and for our farm/plants and livestock	2	-	1	-	-	-	3	-	3	-	1	-	4	-	2	-	4	-	1	-
C. Safe and peaceful community	-	-	4	-	1	-	4	-	7	-	5	-	4	-	8	-	4	-	2	-
D. Clean Environment-fresh air and water, abundant trees and greeneries	2	-	3	-	-	-	4	-	6	-	2	-	4	-	6	-	3	-	2	-
E. Traditional residence of family clan	-	-	1	-	1	-	5	-	5	-	4	-	4	-	1	-	1	-	1	-
F. Atlas Mines/CCC help/provides assistance to our livelihood and community	2	-	5	-	2	-	4	-	6	-	10	-	3	-	6	-	4	-	5	-
G. Palihog pagmonitor sa mga kasikbit nga mga Barangay	1	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-
H. Far from our place of work/livehood	-	4	-	-	-	1	-	-	-	-	-	1	-	1	-	2	-	-	-	-
I. Lack/inadequate supply of water	-	4	-	-	-	2	-	1	-	-	-	4	-	1	-	4	-	1	-	-
J. Threats to community peace and order from drugs & others	-	3	-	-	-	-	-	-	-	1	-	3	-	2	-	1	-	-	-	-
K. Limited or lack of livelihood sources due to degraded soil - unsuitable for farming	-	3	-	1	-	1	-	4		9	-	-	-	1	-	4	-	1	-	-
L. Disasters/Calamities such as Occurance of flooding and landslide due to the following	-	6	-	5	-	3	-	5	--	9	-	8	-	10	-	11	-	4	-	-
M. Contaminated and silted waterways/rivers and water sources	-	5	-	3		3	-	-	-	4	-	6	-	5	-	9	-	2	-	-
Awareness Level and Source of Information																				
Plans to Modify, Improve and Enhance the CCC/ATLAS Facilities such as Carcon, Airstrip Site WR & Tailings Disposal Facilities																				
A. Already aware about the project	5	-	3	-	1	-	6	-	2	-	3	-	3	-	6	-	2	-	1	-
B. Not aware about the project prior to the survey	-	3	-	2	-	7	-	4	-	12	-	12	-	9	-	7	-	3	-	2
Where or how do you learned/knew about this project																				
A. Newspaper/Radio	1	-	-	-	-	-	-	-	-	-	1	-	4	-	5	-	5	-	-	-
B. Atlas/CCC Personnel	6	-	2	-	4	-	7	-	8	-	8	-	4	-	5	-	1	-	2	-
C. Friends, Relatives	1	-	1	-	-	-	-	-	-	-	1	-	2	-	2	-	1	-	-	-
D. Other sources of information	1	-	2	-	-	-	-	-	1	-	2	-	-	-	1	-	1	-	1	-
Are you in favor or not in favor (opposed) of these plans	6	5	5	1	4	3	10	5	13	3	13	3	12	4	11	3	7	1	3	1
Provide direct employment	5	-	5	-	3	-	8	-	12	-	9	-	6	-	6	-	3	-	2	-
Extend the life of the Atlas Mines, thus add more years to the benefits received from the CCC/Atlas	1	-	4	-	-	1	4	-	2	-	-	2	10	-	8	-	1	-	2	-
Favor/ Agree	6	-	5	-	4	-	10	-	13	-	13	-	12	-	11	-	7	-	3	-
Not favor/ Disagree	-	5	-	1	-	3	-	5	-	3	-	3	-	4	-	3	-	1	-	1

Barangay Loay, DAS, Media Once, Biga, Cantabaco, Poog, Bagacay, General Climaco, Campo 8 and Daan Lungsod strongly agreed that SDMP projects have a positive impact to them and the level of awareness about the project is high.

In terms of social acceptability due to foster growth and lifelong development of the community through better and sustainable opportunities, the impact barangays strongly agreed to it. Based on the matrix 74% or 84 persons signifies favorable or agree and 26% or 29 persons disagree to the propose project expansion of the company.

Furthermore, the respondents of the ten (10) identified areas as potential impact barangays (Loay, DAS, Media Once, Biga, Cantabaco, Poog, Bagacay, General Climaco, Campo 8 and Daan Lungsod) agreed that the implementation of project expansion will provide more and better opportunities and improved living conditions and way of life of the people in the community.

2.4.11 Environmental Performance/Mitigation and Enhancement Measures for *'People'* Component

Assessment for Environmental Performance is primarily based on the project's compliance to the EMP of the Toledo Copper Mine Tailings Disposal Facilities-Sigpit Creek (Interim) & Biga Pit PEPRMP, which was issued ECC No. 070612-290278120, dated Dec. 29, 2006. However, the Sigpit Creek (Interim) TSF project was shelved and no development activities whatsoever were undertaken in the area, thus, there was no implementation of the EMP. While in the Biga Pit area, mitigation and enhancement measures are being put-in-placed to address specific concerns.

The following table exhibits the existing (that will be continued) and proposed mitigation/enhancement measures to address identified environmental impacts on 'PEOPLE' of the Toledo Copper Mines TSF and WRD system (existing operations and proposed amendments-new developments).

Table 2.58 **Environmental Performance-Enhancement/Mitigation Measures of Impacts**

Proj Ph	*Envi Component* Potential Impacts	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures
Construction	***PEOPLE***. Hazards, accidents	**Public Safety** *-To prevent inadvertent access by the public into work areas*	Inform public of dangers of entering construction site through public consultation, attended regular barangay meetings and focus group discussion, liaison with the barangay/municipal leaders, display of notices and warning signs
		-To provide continuous and convenient access to public infra (e.g. road) - To avoid disruption to people/community activities (e.g. farming)	• Pipeline construction along roads (right of way) where the local community inside Toledo Copper Mines regularly uses, should not be closed/restricted & disruption of local transport should be avoided • Safety and warning signs shall be put-up • Construction works shall not affect, disrupt or destroy agri/farmlands of the local community. In cases where this cannot be avoided, the farmer/tiller shall be adequately compensated

Operations	***PEOPLE*** Risks, hazards and safety concerns for nearby communities	To address the nearby communities concerns and welfare	• To undertake more consultations and solicit full participation of the communities in updating of CCC SDMP • To compensate for loss of livelihood which may be affected by the project • To provide warning signs and safety devices (e.g. fencing) around Biga Pit to prevent accidental fall (of people using the peripheral road around Biga Pit which may venture into the pit's rim) • To provide buffer (no-build/no access zone) around the Marcona WRD, and fencing of silt ponds • Relocation of houses/public facilities/crops cultivation within the Marcona WRD buffer zone.
		To address the possibility of disastrous flooding influence by excessive discharges of Biga Pit overflow relief waters and accidental releases of tailings	• Adequate and proper compensation for loss, destroyed, damaged, farmlands, crops, properties, etc • Devise and implement detection and early warning system, • CCC involvement in community disaster risk management initiative • Immediately conduct clean up of the affected river systems and coastal areas. Likewise, appropriate rehabilitation of the affected river and coastal areas will be implemented after the clean up; and • Affected farmers and community members will be justly compensated of their damages. • Preparation of Emergency/Contingency Response Plan
Abandonment Restoration	Land/soil, water contamination	-To return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible -to eliminate significant adverse effects on nearby water resources	- salvage, stockpile and use topsoil for reclamation to the extent feasible; - Slopes should be re-contoured to minimize erosion and runoff; - Planting of native species of vegetation and/or other species of vegetation that are environmentally acceptable, should be undertaken

In response to the need for social development and to address concerns on the risks/hazards and responses to emergency situations that would have negative impacts on people, Toledo Copper Mines/CCC prepares the following documents (see Annex for Copies):

a) Annual Social Development and Management Program
b) Surface Emergency Preparedness Plan.

c) EMERGENCY in the event of Typhoons, Heavy Rainfalls or other Adverse Weather Conditions

PART 3 ENVIRONMENTAL RISK ASSESSMENT

Methodology. DENR-MGB Guidelines on the preparation of FMRDP defines risk as the chance of something happening that will have an impact upon objectives. It is further described as a measure in terms of consequences and likelihoods.

A Fault Tree Analyses method has been employed in identifying risks that might affect the project. By this method, program is established, risks identified, analyzed, and evaluated to determine prioritization of actions and strategies to be employed in the decommissioning and rehabilitation process. With the results of the analyses known, risk shall then be treated in terms of priority actions/strategies. Results of environmental impact assessment, social impact assessment, as well as other existing plans of CCC mining operation primarily serve as the data source for the risk assessment of this plan.

Regular monitoring and review (both internal by Safety and Environment Division and external through MRFC) will be conducted to assess progress of rehabilitation and decommissioning. Progress reports will be submitted regularly to MGB-7. Risk assessment and analyses shall be repeated during the review and updating of the FMRDP which occurs every two (2) years as per FMRDP guidelines issued by the DENRMGB. Figure 5.1 shows the overall rehabilitation and decommissioning framework in which risk assessment is an integral part, while Figure 5.2 summarizes the process. On the other hand, Figure 5.3 presents the results of the fault tree analyses.

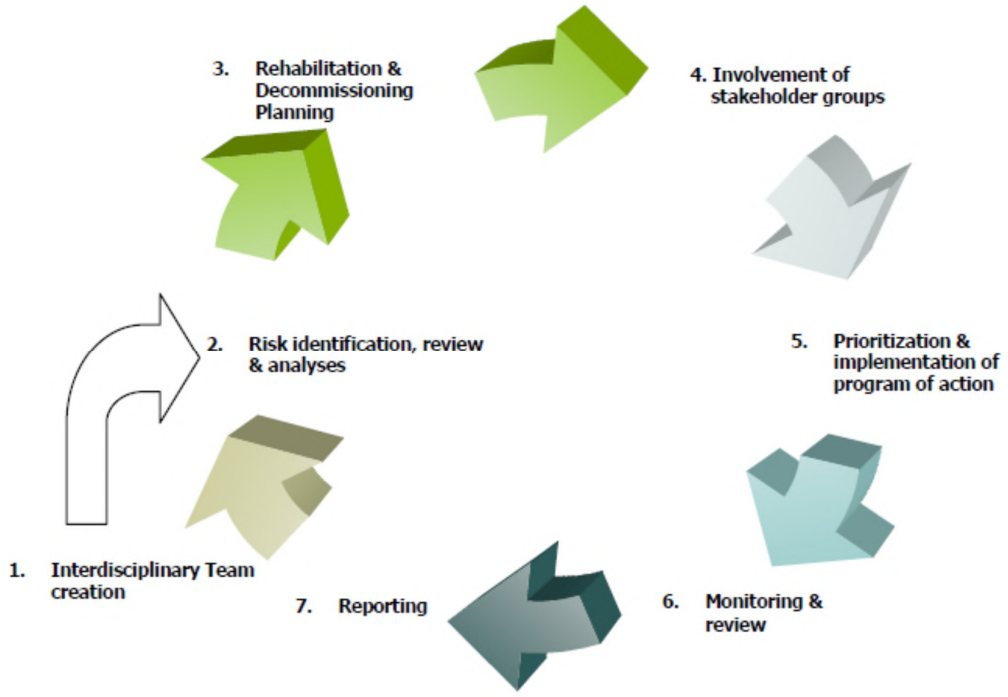

3. Rehabilitation & Decommissioning Planning
4. Involvement of stakeholder groups
2. Risk identification, review & analyses
5. Prioritization & implementation of program of action
1. Interdisciplinary Team creation
7. Reporting
6. Monitoring & review

Figure 3.1 Final mine rehabilitation and decommissioning framework

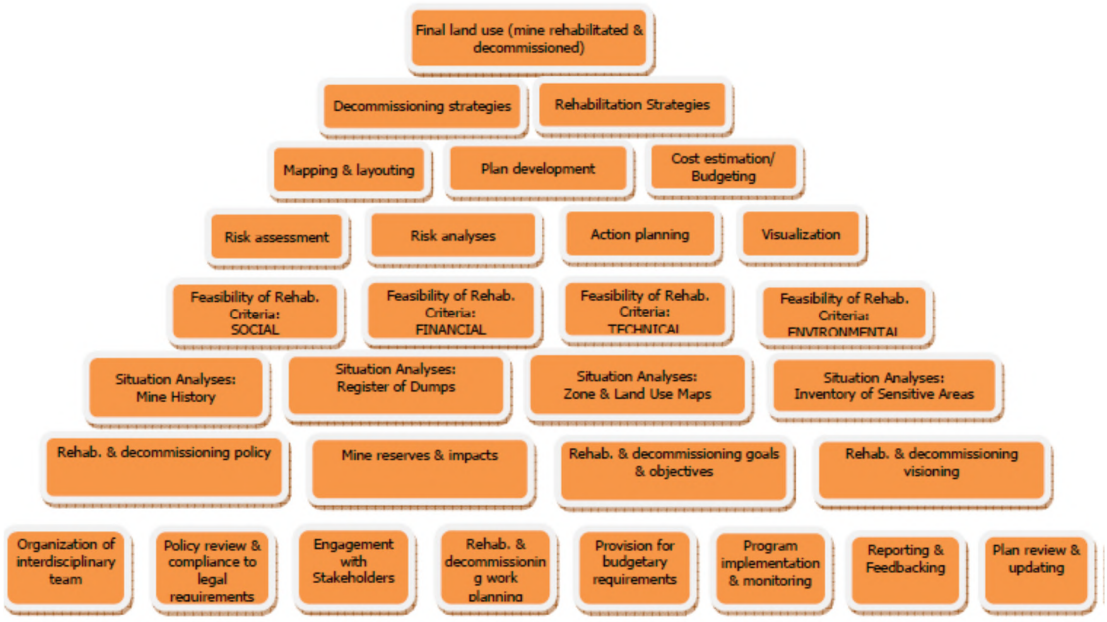

Final land use (mine rehabilitated & decommissioned)
Decommissioning strategies
Rehabilitation Strategies
Mapping & layouting
Plan development
Cost estimation/ Budgeting
Risk assessment
Risk analyses
Action planning
Visualization
Feasibility of Rehab. Criteria: SOCIAL
Feasibility of Rehab. Criteria: FINANCIAL
Feasibility of Rehab. Criteria: TECHNICAL
Feasibility of Rehab. Criteria: ENVIRONMENTAL
Situation Analyses: Mine History
Situation Analyses: Register of Dumps
Situation Analyses: Zone & Land Use Maps
Situation Analyses: Inventory of Sensitive Areas
Rehab. & decommissioning policy
Mine reserves & impacts
Rehab. & decommissioning goals & objectives
Rehab. & decommissioning visioning
Organization of interdisciplinary team
Policy review & compliance to legal requirements
Engagement with Stakeholders
Rehab. & decommissioning work planning
Provision for budgetary requirements
Program implementation & monitoring
Reporting & Feedbacking
Plan review & updating

Figure 3.2. Final mine rehabilitation & decommissioning pyramid.

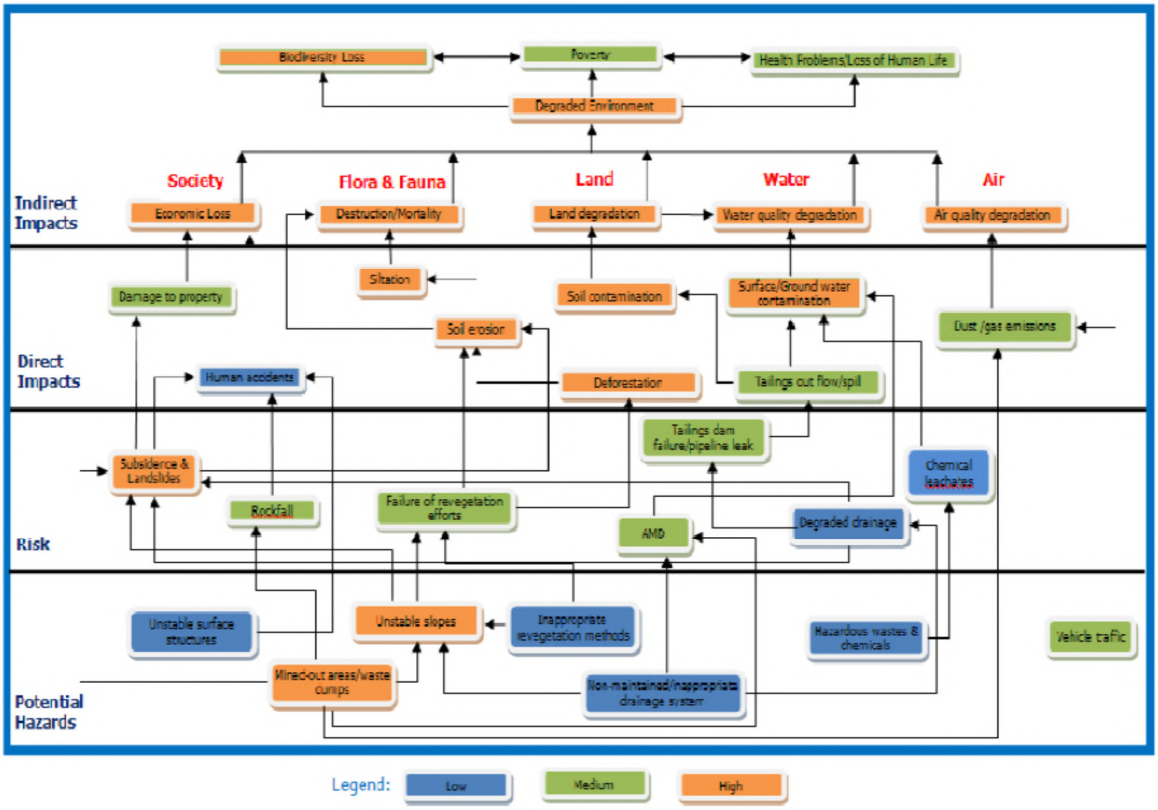


Figure 3.3. Fault tree analyses of environmental and social risks of CCC mining operations, final mine rehabilitation, and decommissioning

Major Risks and Impacts. DENR-MGB Guidelines on the preparation of FMRDP defines risk as the chance of something happening that will have an impact upon objectives. It is further described as a

measure in terms of consequences and likelihoods. Results of the Environmental Impact Assessment (EIA) and Social Impact Assessment
(SIA) highlight the following major impacts/issues which would need to be addressed in relation to the mine rehabilitation and/or decommissioning program. To wit:

Environmental risks/impacts. The major environmental risks/impacts relative to mining operations, rehabilitation, and closure are the following:

- Tailings containment failure and tailings spillage;
- Air quality degradation due to airborne dust and gas emissions;
- Collapse of unstable mine structures and facilities;
- Acid mine drainage;
- Leachates of hazardous wastes and chemicals;
- Subsidence of voids/open pits and underground tunnels;
- Landslides of unstable slopes;
- Surface erosion of waste dumps and disturbed landforms;
- Siltation of river channels;
- The presence of significant drainage systems in the vicinity might increase possibility of ground water contamination by heavy metals;
- Soil and groundwater contamination by heavy metals and other pollutants;
- Slow progress in mine revegetation, if not, failure of revegetation efforts due to factors such as extremely adverse site condition of the mined out areas, inappropriate revegetation methods, etc.;
- Aridity and exposure to high temperature and winds of areas due to mining activities;
- Land degradation; and
- Biodiversity loss;

Social risks and impacts. Impacts relative to each social component have been detailed in the referenced management plans (i.e., SDMP, EPRMP, etc.). The major impacts and issues that apply to the mining operation, final mine rehabilitation, decommissioning, and closure are the following:

- Unemployment/retrenchment;
- Presence of adjacent communities which might illegally and uncontrollably encroach in the rehabilitated area, poach on the forest trees planted, and/or scavenge in the remaining scraps that might not be disposed of properly;
- Uncontrolled community activities also adversely affects reforestation efforts through their unmanaged livestock raising, kaingin farming (which may cause wildfires in adjacent tree plantations of the company), etc.;
  - ☐ Inadvertent access to the pit by local communities and/or unauthorized individuals;
  - ☐ Discontinuation of programs to manage health problems and diseases. The halt of medical and other health services extended by the company to its employees and their dependents will force residents in the area for scarce, underfunded and undermanned public health center. This will be causing additional strain in public services;
  - ☐ Changes in livelihood strategies and household income generation. Income of households with no land, capital, or marketable skills will likely come from marginal farming, small scale mining and quarrying, harvesting of forest products, scavenging of remaining scraps, retailing/vending, or employment in low skilled or unskilled work within or outside the locality;
  - ☐ Discontinuation of water supply and sanitation program. The source of domestic water supply of residents in the primary impact barangays are shallow and deep wells, springs, and rain water which can easily be contaminated. Since, ACMDC time, residents depend on the water system of the company but this might again gradually deteriorate with mine closure. Coverage of level III water supply system is limited to a small portion of residents in the area. Thus, without the company, residents in the primary impact barangays will have limited access to a clean and drinking water that meets statutory standards; and

- Safety and security implications from activity on site. The absence of security guards that regularly patrol the area might encourage illegal or unregulated forest and mine resources extraction activities, inadvertent access to the pit area, and others. With this the local police or the Barangay Tanods will have to intensify or extend patrol coverage which may be a strain to government resources.

Mine Closure and Rehabilitation Scenarios

Planned Closure. Generally, all infrastructure, facilities, and equipment listed as fixed assets as per CCCACMDC operating agreement shall be turned over to Atlas, if not, stored/maintained for future use. Otherwise, if agreed by both parties, these will be turned over to other stakeholders for their sustainable use and development. Those which do have future use will be demolished.

All onsite electrical and water reticulations and other items recovered from the decommissioning/demolition activities will be sold or disposed of appropriately. Those that are still usable for future projects of CCC or ACMDC shall be subjected to safekeeping.

Abandoned areas, waste rock dumps, and mined-out areas, among others will be environmentally Rehabilitated.

In some areas, progressive rehabilitation/revegetation will be conducted, however, only after concerned operation areas give clearance to the Reforestation Section. Other areas that are directly affected or are continually used relative to mine operations during mine life will be subjected to revegetation only after final mine closure.

Socio-economic impacts as a result of mine closure will be addressed appropriately through the SDMP. Handover of infrastructure, facilities and rehabilitated land will be negotiated with the identified Stakeholder groups with the assurance of the beneficiary stakeholder groups that such will be sustainably used, developed or managed. Where applicable, issuance of appropriate tenurial instruments by concerned government agency shall be made.

Temporary Closure (Care and Maintenance). Taking into consideration the potential for future operation of the site, a Care and Maintenance Program (CMP) shall be immediately prepared and implemented. The CMP will prioritize the establishment of a skeletal organization responsible for the implementation of Care and Maintenance activities. Activities would include, but not limited, to maintenance of administration records and facilities, continuous monitoring and maintenance of the Biga Pit Tailings Disposal Facility, existing peripheral drainage system, and reforested/afforested areas. Reforestation of Biga Waste Dumps will continue either thru reforestation activities by the maintenance and forest protection crew or the existing community organization operating within the area.

Activities under the CMP will continue until such time when the company will decide to revive the mining operation or completely cease the project, wherein all programs under the FMRDP be immediately implemented.

Sudden or Unplanned Closure. If such scenario would arise resulting from financial constraints or as directed by regulatory agencies, immediate implementation of the decommissioning plan would be undertaken based on the existing Final Mine Rehabilitation Decommissioning Plan.

Subsequently, activities scheduled after receipt of a notice of closure would follow the planned closure scenario, wherein all fixed assets would be turned over to Atlas while areas and facilities which do not have identified future use will be demolished and eventually rehabilitated thru reforestation.

Table 2.59 Qualitative Risk Assessment for TCM

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
1. PHYSICAL HAZARD						
1.1 Geological Hazards						
Ground shaking	• Earthquake	• Shaking of foundation, structures • Ground rupture • Liquefaction • Slope failure	Injury or death	Moderate Risk	• Avoid building on ground with high seismic attenuation potential • Design and construct the additional facilities for Carcon and the expansion of Airstriip. MarcoAn WRDS and other facilities according to acceptable standards based on realistic earthquake scenarios • Use strong containment materials/methods for storage of chemicals and flammable/explosive substances • Establish an Earthquake Emergency Response Plan	Low Risk
			Biga & Malubog Dam breach or collapse	High Risk		Low Risk
			Damage / destruction of pipelines	High Risk		Low Risk
			Damage / destruction of other facilities	High Risk		Low Risk
			Collapse/Landslide of Open Pit Walls	High Risk		Low Risk
			Loss / reduction of access	High Risk		Low Risk
			Explosion or fire	Moderate Risk		Low Risk
Ground rupture	• Earthquake	• Formation of ground cracks • Uplifting/ subsidence of ground	Injury or death	Moderate Risk	• Design and construct the additional facilities for Carcon and the expansion of Airstriip. MarcoAn WRDS and other facilities according to acceptable standards based on realistic earthquake scenarios • Use strong containment materials/methods for storage of chemicals and flammable/explosive substances • Establish an Earthquake Emergency Response Plan	Low Risk
			Maubog & Biga Dam breach or collapse	Moderate Risk		Low Risk
			Collapse/Landslide of Open Pit Walls	High Risk		Low Risk
			Damage / destruction of pipelines	Moderate Risk		Low Risk
			Damage / destruction of other facilities	Moderate Risk		Low Risk
			Loss / reduction of access	Moderate Risk		Low Risk
			Explosion or fire	Moderate Risk		Low Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
Liquefaction	• Earthquake	• Loosening of ground stability	Injury or death	Low Risk	• Avoid building on ground with high liquefaction susceptibility • Establish an Earthquake Emergency Response Plan Use strong containment materials/methods for storage of chemicals and flammable/explosive substances • Use strong containment materials/methods for storage of chemicals and flammable/explosive substances	Minimal Risk
			Malubog & BTSF Dams breach or collapse	Low Risk		Minimal Risk
			Damage / destruction of pipelines	Low Risk		Minimal Risk
			Collapse/Landslide of Open Pit Walls	Low Risk		Minimal Risk
			Damage / destruction of other facilities	Low Risk		Minimal Risk
			Loss / reduction of access	Low Risk		Minimal Risk
			Explosion or fire	Low Risk		Minimal Risk
Earthquake-induced landslide	• Earthquake	• Slope failure	Injury or death	Moderate Risk	• Avoid building on highly fractured steep slopes • Design and construct the additional facilities for Carcon and the expansion of Airstriip. MarcoAn WRDS and other facilities according to acceptable standards based on realistic earthquake scenarios	Minimal Risk
			Malubog & BTSF Dams breach or collapse	Low Risk		Minimal Risk
			Damage / destruction of pipelines	Low Risk	according to acceptable standards based on realistic earthquake scenarios • Use strong containment materials/methods for storage of	Minimal Risk
			Damage / destruction of pipelines	Low Risk		Minimal Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
			Collapse/Landslide of Open Pit Walls	Moderate Risk	chemicals and flammable/explosive substances • Establish an Earthquake Emergency Response Plan	Minimal Risk
			Damage / destruction of other facilities	Moderate Risk		Minimal Risk
			Loss / reduction of access	Moderate Risk		Minimal Risk
			Explosion or fire	Low Risk		Minimal Risk
Rain-induced slope failure	• High pore water pressure	• Slope failure	Injury or death	Moderate Risk	• Provide appropriate drainage systems to reduce water saturation in ground • Engineer stable slopes • Set up piezometers and other groundwater / seepage monitoring systems	Minimal Risk
			Dam breach or collapse	Low Risk		Minimal Risk
			Damage / destruction of pipelines	Low Risk		Minimal Risk
			Collapse/Landslide of Open Pit Walls	Moderate Risk		Minimal Risk
			Damage / destruction of other facilities	Moderate Risk		Minimal Risk
			Loss / reduction of access	Moderate Risk		Minimal Risk
Flooding	• Intense rainfall	• Inundation of facilities	Injury or death	Low Risk	• Avoid building in low-lying areas and natural drain ways of floods	Minimal Risk
			Malubog & BTSF Dams breach or collapse	Low Risk		Minimal Risk
		• Erosion of river banks • Heavy sedimentation in distal	Damage / destruction of pipelines	Low Risk	• Construct bunds and other flood control works • Install an early warning system for floods • Plan spillway releases in both	Minimal Risk
			Soil Erosion & loosening of Open Pit walls	Moderate Risk		Minimal Risk
			Damage / destruction of other facilities	Low Risk		Minimal Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
		downstream areas	Loss / reduction of access	Low Risk	reservoirs	Minimal Risk
Differential settlement	• Earthquake • Compression of different substrate materials	Unevenness of ground	Injury or death	Low Risk	• Conduct detailed geomechanical investigation prior to construction • Design and construct facilities according to geomechanical properties of the rock. Use strong containment materials/methods for storage of chemicals and flammable/explosive substances	Minimal Risk
			Malubog & BTSF Dams breach or collapse	Low Risk		Minimal Risk
			Damage / destruction of pipelines	Low Risk		Minimal Risk
			Damage / destruction of other facilities	Low Risk		Minimal Risk
			Loss / reduction of access	Low Risk		Minimal Risk
Atmospheric Hazard						
Tropical cyclones	• Weather systems	• Intense rainfall • Flooding • Strong winds • Slope failure	Injury or death	Moderate Risk	Keep updated with the latest weather bulletin Design and maintain sufficient freeboard Monitor ground pore water pressure • Design spillway that can accommodate extreme weather discharges	Minimal Risk
			Malubog & BTSF Dams breach or collapse	Low Risk		Minimal Risk
			Damage / destruction of pipelines	Low Risk		Minimal Risk
			Collapse/Landslide of Open Pit Walls	Low Risk		Minimal Risk
			Damage / destruction of other facilities	Moderate Risk		Minimal Risk
			Loss / reduction of access	Moderate Risk	• Limit exposure to the elements during extreme weather	Minimal Risk
Heavy rainfall			Injury or death	Low Risk	Keep updated with the latest	Minimal Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
	• Tropical cyclones • Monsoon rains	Flooding Slope failure	Dam breach or collapse	Low Risk	weather bulletin Design and maintain sufficient freeboard Monitor ground pore water pressure • Design spillway that can accommodate extreme weather discharges Provide sufficient drainage system Limit exposure to the elements during extreme weather	Minimal Risk
			Collapse/Landslide of Open Pit Walls	Low Risk		Minimal Risk
			Damage / destruction of pipelines	Low Risk		Minimal Risk
			Loss / reduction of access	Moderate Risk		Minimal Risk
Geomechanical	•	•			•	
Dam failure	• Earthquake / fault movement • Seepage / leakage • Heavy rainfall • Spillway damage • Poor design or construction	• Inundation of immediate downstream areas • Riverbank erosion • Landslides in embankment slopes	Injury or death	High Risk	• Avoid building on ground with high seismic attenuation potential • Design and construct dam according to acceptable standards based on realistic earthquake scenarios • Use strong containment materials/methods for storage of chemicals and flammable/explosive substances	Low Risk
			Massive flooding	High Risk		Low Risk
			Damage / destruction of other facilities	High Risk		Low Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
					• Establish an Earthquake Emergency Response Plan • Maintain acceptable freeboard • Design spillway that can accommodate extreme weather discharges • Restrict access to the dam • Include the following parameters for TSF monitoring: o Piezometric levels presented in linear graph with rainfall and operational pond water level. o Visual indications of displacement, creep, deformation on embankment o Visual inspection of spillway, seepage collection pond, and other hydraulic structures o Tailings level o Operational pond level o Freeboard level o In situ water quality for TSF discharge, seepage collection pond and groundwater (pH, turbidity)	
Subsidence Zone Failure	• Earthquake /	• Slope failure	Injury or death	High Risk	• Conduct detailed geomechanical	Low Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
	fault movement • Heavy rainfall • High angle of pit slopes	• Ingress of groundwater into subsidence zone • Propagation of tension cracks • Impoundment of water at pit floor • Inundation of	Damage / destruction of equipment	High Risk	investigation prior to construction • Design and construct facilities according to geomechanical properties of the rock. • Monitor groundwater around the open pit • Monitor deformation of slopes • Provide appropriate drainage and/or dewatering system • Provide slope protection, if necessary	Low Risk
			Damage / destruction of equipment	Moderate Risk		Minimal Risk
Occupational Hazards						
Mechanical hazards	• Forceful movement of sharp/blunt mechanical parts • Equipment malfunction • Human error • Poor quality of machines Poor protection	• Fire / smoke emission / explosion (from burnt machinery) • Water leakage (from broken pipes / hydraulic pumps) • Oil leakage (from faulty machinery) • Increase in noise levels	Injury or death	Moderate Risk	• Require personal protective equipment for all workers handling mechanical equipment • Provide first aid kits • Provide emergency medical evacuation • Provide sufficient ventilation Proper maintenance of machinery and equipment • Restrict usage of mechanical equipment to experienced workers Provide fire suppression systems Report incidents and faulty	Minimal Risk
			Heat stress	Moderate Risk		Minimal Risk
			Fatigue from repetitive movement	Low Risk		Minimal Risk
			Loss of hearing	Low Risk		Minimal Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
		• Increase in heat emissions			equipment	
Electrical	• Fire / explosion • Mechanical malfunction • Electromagnetic surges • Poor quality of electric wirings / power lines	• Fire / explosion (when in contact with combustible / explosive substances) • Power outage • Mechanical breakdown	Injury or death	Moderate Risk	• Require personal protective equipment for all workers • Provide first aid kits • Provide emergency medical evacuation Proper maintenance of machinery and equipment • Restrict usage of electrical equipment to experienced workers • Provide fire suppression systems	Minimal Risk
			Electrocution	Moderate Risk		Minimal Risk
			Exposure to electromagnetic fields	Moderate Risk		Minimal Risk
	• Exposed wirings •Human error Poor protection				• Report incidents and faulty equipment • Establish buffer area around switchyard / transformer areas	
Pressure hazards	• Overpressure of pneumatic and hydraulic equipment	• Fire / explosion • Mechanical breakdow	Injury or death	Low Risk	• Require personal protective equipment for all workers • Provide first aid kits • Provide emergency	Minimal Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
	• Poor protection • Explosions	n • Increase in temperature	Heat stress	Low Risk	medical evacuation • Proper maintenance of machinery and equipment • Provide sufficient ventilation • Ensure that pressure gauges, valves, and monitors are all working • Restrict usage of mechanical equipment to experienced workers • Provide fire suppression system Report incidents and faulty equipment	Minimal Risk
Temperature hazards	• Increase in natural ambient temperature	• Fire / explosion (of faulty equipment or	Injury or death	Moderate Risk	• Require personal protective equipment for all workers handling mechanical equipment	Minimal Risk
			Heat stress	Moderate Risk		Minimal Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
	• Operation of heat-emitting equipment • Confined space with little ventilation • Fire / explosion • Equipment malfunction • Poor protection	when in contact with combustible / explosive substances) • Mechanical breakdown			or working in exposed environments • Provide first aid kits • Provide emergency medical evacuation • Provide sufficient ventilation Proper maintenance of machinery and equipment • Restrict usage of mechanical equipment to experienced workers • Provide fire suppression systems Report incidents and faulty equipment	
Biological hazards	• Animal / insect bites • Contamination by pathogens • Contact with poisonous plants • Poor hygiene • Ingestion of spoiled food	• Outbreak (for highly contagious diseases) or contamination • Loss / reduction of movement / mobility	Allergic reactions	Low Risk	• Maintain personal hygiene • Confinement / quarantine for infected personnel • Provide animal bite kits Provide emergency medical evacuation • Wear appropriate protective equipment when conducting work in highly vegetated areas • Orient workers with dangerous flora and fauna in project site • Avoid contact with unfamiliar plants and animals • Report incidents	Minimal Risk
			Vomiting / upset stomach from ingested plants	Low Risk		Minimal Risk
			Contraction of communicable diseases	Low Risk		Minimal Risk
			Pain from animal bites	Low Risk		Minimal Risk
			Poisoning from animal bites and toxic plants	Low Risk		Minimal Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
Radiation hazards	• Intense illumination • Radiation-emitting devices • Poor protection Human error	• Intensification of light levels • Increase in temperature	Injury or death	Low Risk	• Require personal protective equipment for all workers handling equipment or working in exposed environments • Provide first aid kits • Provide emergency medical evacuation • Provide sufficient ventilation • Proper maintenance of machinery and equipment • Restrict usage of radiation- emitting equipment to experienced workers • Provide fire suppression systems Report incidents and faulty equipment	Minimal Risk
			Heat stress	Low Risk		Minimal Risk
			Permanent or temporary blindness	Low Risk		Minimal Risk
Noise hazards	• Explosions • Operation of equipment • Faulty equipment • Poor protection	Increase in ambient noise	Temporary or permanent deafness	Moderate Risk	• Provide ear mufflers for workers exposed to loud operational environments • Proper maintenance of machinery and equipment • Restrict usage of mechanical equipment to experienced workers • Provide noise buffers • Operate noise-generating equipment only at designated areas and during assigned schedule	Minimal Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
Gravity hazards	• Falling objects • Collapse of foundation / roofing • Loss of support • Shifting of center of gravity • Poor protection	• Impact / collision	Injury or death	Moderate Risk	• Secure objects used at height • Provide sufficient support / footing of scaffolds / ladders, etc. • Provide early warning signs around activities conducted at elevation • Require personal protective equipment for all workers • Provide first aid kits • Provide emergency medical evacuation • Safety training for all employees • Report incidents	Minimal Risk
Motion hazards	• Loss of control • Poor ergonomics / posture • Poor illumination • Poor protection	Impact / collision	Injury or death	Low Risk	• Provide signages and other early warning signs • Require personal protective equipment for all workers • Provide sufficient illumination • Follow traffic rules • Maintain vehicles regularly Restrict operation to capable workers • Safety training for all employees • Report incidents	Minimal Risk
			Fire or explosion	Low Risk		Minimal Risk
Insurgency	• Political / economic instability	• Restriction of ground movem	Injury or death	Low Risk	• Be aware of security risks outside the project area • Inform Safety Officer	Minimal Risk

Hazard/Threat	• Cause / Fault / Failure	• Consequence Event(s)	**Outcome**	**Potential Probability (Unmitigated**	**Safety Measure and Mitigation**	Potential Probability (Mitigated)
		ent / access	Loss of property	Moderate Risk	or designated personnel of whereabouts at all times • Provide security escort, if necessary • Secure property when working outside project perimeter	Minimal Risk

PART 4 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management and Monitoring Plan comprises of three (3) sub-sections/matrices: Environmental Impact Management Plan (IMP); the Environmental Monitoring Plan (EMoP), and the supplementary plans

4.1 IMPACT MANAGEMENT PLAN

The IMP summarizes (with reference to the discussions in Section 4: Baseline Conditions, Impact Assessment and Mitigation, and Environmental Performance) the proposed Toledo Copper Mine Tailings Storage/Disposal facility project's potential impacts and the corresponding proposed enhancement and mitigation measures – that particularly deal with identified impacts on various environmental resources/attributes (land, water, air and people) during the pre-construction/construction, operation, and abandonment/post-closure phases.

Table 4.1 **Impact Management Plan for Biga TSF**

Phase	Land Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsi-ble Party	Guarantee, MOA
LAND						
CONSTRUCTION/DELEOPMENT OF THE ADDITIONAL/MODIFIED CARCON FACILITY, EXPANSION/MODIFICATION OF AIRSTRIP WRD	Soil	Removal, disturbance of top soil during land clearance for the affected areas (development footprints of proposed modifications)	The soil will be stockpiled and retained for future revegetation programs. (This will be done on appropriate areas affected by development activities)	60% stockpiled of removed soil for future applications 40% utilized for on-going reforestation projects & landfilling of depressed areas	Part of budget for Php 15.9M	Environmental Protection and Enhancement Program (EPEP)
		Contamination of soils from spilled fuel, oils and lubricants from construction vehicles	• Develop & implement emergency response procedures which will specify the steps to be taken in the event of fuel or oil spill • Standard maintenance & clean-up procedures	100% compliance to RA 9275 & its IRR, DAO 2013-22		ECC/SOP at the motorpool area
	Land use	Land use in and around the construction area will become restricted area. Existing land use such as 'forestal, marginal agriculture' will be affected	• Safety and warning signs shall be put-up • Limited access shall be provided if necessary for barangay residents within TCM (such as passing through an access road)	100% implementation of safety measures		Annual Safety Program
	Landscape and Visual Character	Alteration of visual character of the area due to removal of vegetation and the top soil	• Limit removal of trees in areas identified for development. • Proper utilization of harvested trees, i.e. Donate lumber/fire wood to affected communities. • conduct immediate rehabilitation/revegetation of the affected areas.	100% implementation of reforestation programs/projects	Part of reforestation –wildlife protection project's budget (Php 360,000)	Environmental Protection and Enhancement Program (EPEP)
	Flora & Fauna	Removal of vegetation, site clearing and grading for development footprints of the Carcon facility, Airstrip WRD expansion and other future construction activities causes loss of habitat for small mammals, birds and insects	To prepare a fauna management plan, that includes the following measures: *conduct fauna/wildlife inventory; fauna monitoring; return of fauna habitats to rehabilitated areas; translocation of fauna; establish a protected wildlife habitat area*	100% preparation of faunal management plan		ECC/CCC Budget for this sub-proj

Phase	Land Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsi-ble Party	Guarantee, MOA
OPERATIONS	Soil/Ground Permeability	Leaching of pollutants/heavy metals at Biga Pit's bottom causing soil and groundwater contamination	• Regular monitoring of ground and surface water quality; • Identify water quality sampling sites for regular monitoring for the possibility of ground and aquifer contamination.	100% implementation of monitoring plan and compliance to other regulations, eg. Discharge permit, handling/ disposal of Hazarodous & toxic wastes	CCC budget of (Php 500,000)	ECC
Operations	Soil	Soil Erosion and sedimentation degrading surface (river) water quality. Surface run-off causing erosion and transporting sediments from surrounding areas going into the peripheral drainage canals and the Biga Pit itself	• Retain sediment on-site (within Toledo Copper Mines) through putting-up of sediment pond or a series of catch basins for the peripheral stormwater run-off drainage canal to prevent sediments from going into the Cumba River and other drainage outfalls. • Improve/enhance drainage system immediately surrounding project sites (Carcon facility, Airstrip WRD) and existing and future developments	100% maintenance of siltation ponds and drainage systems	Part of budget and AEPEP (Php 13,000,000)	ECC
		Loss of soil fertility & potential amenity for agriculture/forestal through erosion/sedimentation and contaminated run-off from TSF	Adequate and proper compensation for loss of agricultural and forest lands and its potential for production-economic amenity	100% implementation of agreed compensation plan for affected residents/farmers (Once the Marcon WRD project will be implemented)	Part of ASDMP budget Of (Php 700,000)	ECC
	Land Use pattern	Flooding of areas along waterways and its overall effects on the river basin land use pattern	Support Toledo City Government's program, particularly on the following projects: Rehab/protection, reforestation & stabilization of riverbanks, river rechanneling, flood control and others	100% support to such notable projects	CCC, Toledo City Government	ECC, MOA
	Landscape and Visual Character	Alteration of visual character of the area due to loss of vegetation and landform changes	Implementation of the approved annual reforestation/rehabilitation program.	100% implementation of refo/rehabilitation projects/programs	Part of reforestatio	EPEP

Phase	Land Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsi-ble Party	Guarantee, MOA
	Flora & fauna, People	Loss of vegetation, loss of habitat for small mammals, birds and insects	• Limit removal of trees in areas identified for development. • Proper utilization of harvested trees, i.e. Donate lumber/fire wood to affected communities. • If applicable, conduct immediate rehabilitation/revegetation of the affected areas. • Undertake biodiversity conservation programs within and the immediate surroundings of TCM	100% implementation of refo/rehabilitation projects/programs & development of biodiversity conservation plans/ programs	n project's budget (Php 1,628,000)	EPEP
	Geotechni-cal Engg	Excessive erosion or failure of the WRDs and Dams (e.g Malubog & Biga)	• Establish and maintain an appropriate peripheral drainage. • Reforestation/rehabilitation of affected areas • Regular inspection of facility structural integrity	100% undertaking of improvement & maintenance of drainage system 100% conduct of regular inspection & maintenance works		EPEP
Abandonment-Restoration	Land/soil, water contaminati on	To return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible -to eliminate significant adverse effects on nearby water resources	• Rehabilitation of the affected areas based on the programs stated in the approved FMRDP. • Slopes should be re-contoured to minimize erosion and runoff. • Planting of appropriate species of vegetation and/or other species of vegetation that are environmentally acceptable.	100% implementation of refo/rehabilitation projects/programs	Part of the FMRDF budget Php 21 M	FMRDP, EPEP
WATER						
Construction	Surface water	Erosion of exposed topsoil by construction activities (removal of soil and woodland) may impact on surface watercourses through soil erosion and contamination	Establish and maintain an appropriate peripheral drainage.	100% undertaking of improvement & maintenance of drainage system	Part of the Drainage maintenanc e budget (Php 9,175,000)	EPEP
		Removal of soil and vegetation will change the nature of the watershed feeding the project watercourses	Implementation of the approved reforestation/revegetation program	100% conduct of regular inspection & maintenance works	Program/pro ject budget (Php 1,628,000)	FMRDP, ECC

Phase	Land Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsi-ble Party	Guarantee, MOA
		Contamination of water from the accidental release of hydraulic fluid, oil or fuel from construction vehicles	• Develop & implement emergency response procedures which will specify the steps to be taken in the event of fuel or oil spill (contractor) • Standard maintenance & clean-up procedures	100% compliance to RA implementation of monitoring plan and compliance to other regulations, eg. Discharge permit, handling/ disposal of Hazarodous & toxic wastes	Part of budget and AEPEP (Php 13,000,000)	EPEP, General Procedure 003 (Contractor Management Procedure)
	Groundw-ater	Contamination of groundwater from the accidental release of hydraulic fluid, oil or fuel from the construction vehicles	• Develop & implement emergency response procedures which will specify the steps to be taken in the event of fuel or oil spill • Standard maintenance & clean-up procedures	100% compliance to RA 6969, RA 9275 and conditions of the Discharge Permit		
OPERATIONS	Hydrology/ Flooding	Discharges of Biga Pit overflow relief water influence excessive increase in volume of Sigpit river flow rates causing flooding in downstream (lower sigpit and sapangdaku) areas	• Control releases of discharges not to exceed the allowable limits/thresholds applied/covered by the issued Discharge Permit for the Biga TSF. • Management and control of Biga Pit discharge through the Biga TSF Decant System during heavy rainfall and storms/typhoons. • Consistent/efficient monitoring & feedback of weather/climate patterns (esp. weather disturbances, and amount of rainfall) • Implement Zero Waste Discharge	100% compliance to RA 6969, RA 9275 and conditions of the Discharge Permit 100% implementation of Zero-waste discharge program		ECC, EPEP
	Hydro-geology	Penetration of pollutants/ heavy metals from Carcon Facility, Motorpool, work area, TSF, WRDs, erc.	• Regular monitoring of ground and surface water quality; • Identify water quality sampling sites for regular monitoring for the possibility of ground and aquifer contamination.	100% compliance to RA 6969, RA 9275 and conditions of the Discharge Permit 100% implementation of Zero-waste discharge program	Part of EPEP Budget (Php 15,402,000)	EPEP
	Water Quality	Transport of water-borne contaminants from Carcon Facility,	• Provision of Sedimentation/Settling Pond/ Water Treatment facility (after or before the Decant Tower. ***Location/Capacity of Settling Pond: Sigit***	100% compliance to RA 6969, RA 9275 and		EPEP, ECC

Phase	Land Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsi-ble Party	Guarantee, MOA
		Airstrip & other WRDs, Motorpool, work area, Biga TSF, erc.	***(52,562 cum, Udlom Settling Pond, Emergency Tailings Pond (35,737.72 cum)*** • Dilution by the water inflow • Dilution by lime additive (if pH increases) • Water recovery & treatment (if needed) • Physical & chemical treatment for specific type of pollutants (e.g phosphate & nitrates) which may exceed the standards) (if needed/necessary)	conditions of the Discharge Permit 100% implementation of Zero-waste discharge program 100% implementation of maintenance works for settling ponds		
		Soil Erosion and sedimentation increases suspended particulates in surface water. degrading surface (river) water quality. Surface run-off causing erosion and transporting sediments from surrounding areas going into the peripheral drainage canals and the Biga Pit itself	Implement Erosion & Sedimentation Control (ESC) Measures/Plan that includes, among others: • Retain sediment on-site (within TCM) through putting-up of sediment pond or a series of catch basins (berms and silt traps) for the peripheral stormwater run-off drainage canal to prevent sediments from going into the Cumba River and other drainage outfalls. • Improve/enhance drainage system immediately surrounding Biga Pit (right after road) through the following: a) road side (Biga Pit side) drainage canal with cross-drains for run-off to be directed to the opposite canal (leading to River outfall) and not to Biga Pit	100% implementation of ESC measures/plan		EPEP
AIR						
CONSTRUCTION	***AIR***. Air pollution	*generation of dust form movement of haul trucks & other heavy equipments*	• Active areas will be routinely sprayed with water in order to suppress dust. **Frequency of Spraying: *1 pass in the morning and 1 pass in the afternoon. However, during dry season it is adjusted to 2 passes both in the morning and afternoon or as need arise.*** • Preservation and planting of trees, vegetation around the TSF as buffer/tree filters	100% compliance tp RA 8749 & DAO 2000-81 100% implementation of spraying schedules 100% implementation of reforestation program	Part of EPEP Budget (Php 9,000,000)	EPEP

Phase	Land Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsi-ble Party	Guarantee, MOA
OPERATIONS	***AIR***. Air pollution	*effects of air pollutants on nearby areas; dusts generation from dumping & wind-induced erosion of dumps*	• Active areas will be routinely sprayed with water in order to suppress dust. **Frequency of Spraying: *1*** *pass in the morning and 1 pass in the afternoon. However, during dry season it is adjusted to 2 passes both in the morning and afternoon or as need arise.* • reforestation/rehabilitation of affected areas after completion of the activity.	100% compliance tp RA 8749 & DAO 2000-81 100% implementation of spraying schedules		EPEP
		contamination of air due to dust emissions from vehicles & trucks operating on dirt roads	• Water spraying will be conducted on all affected roads. **Frequency of Spraying: *1*** *pass in the morning and 1 pass in the afternoon. However, during dry season it is adjusted to 2 passes both in the morning and afternoon or as need arise.*	100% compliance tp RA 8749 & DAO 2000-81 100% implementation of spraying schedules		EPEP
	Noise & Vibration	Noise and vibration caused by TSF activities disturb wildlife	Proper scheduling ***(within the 8am-5pm daylight***) of activities so as not to cause disturbance to wildlife	100% compliance to working hours schedule	Part of EPEP Budget (Php 9,000,000)	EPEP
	LAND/Soil, air, water contamination	Accidents, damaged to infrastructure - soil, air and water contamination, and damaged to infrastructures	• Implement proper maintenance on all affected roads • Implement speed limits in all areas • Water spraying will be conducted on all affected roads. **Frequency of Spraying: *1*** *pass in the morning and 1 pass in the afternoon. However, during dry season it is adjusted to 2 passes both in the morning and afternoon or as need arise.*			EPEP
	WASTE MANAGE-MENT Soil, air, water contamination	Generation of industrial waste-scrap metal, empty containers, etc., that will be generated from TSF operations	Prepare a waste management plan, that, among others, will provide guidelines & procedures of proper waste management		OPEX/ EPEP Budget (Php 7,400,000)	CCC Waste Management Program
		Reusable materials should be reused or recycled to reduce amount of waste generated	Establish and maintain storage areas for reusable materials; reusable materials include empty drums, timber, etc. these will be reused by the quarry, sold or donated to interested parties. ***MRF Capacity 60,000 cu.m. @ Location 20/Minesite***	100% compliance to RA 9003, RA 6969 and their IRR/guidelines 100% installation & operation of MRFs		Operation and Management of Location 20

Phase	Land Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsi-ble Party	Guarantee, MOA
		Prevent hazardous waste from contaminating soils and water	Hazardous wastes will be stored in a secure area. Disposal will be trough accredited Treatment and Storage Service Providers. ***A number of HazWastes facilities are in-placed (see Section 2.1..1..5, Table 2.6, p. 110 for location and capacity)***	100% compliance to RA 9003, RA 6969 and their IRR/guidelines 100% installation & HazWastes Storage Facility		EPEP
Abandonment Restoration	Land/soil, water contamination	return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible -to eliminate significant adverse effects on nearby water resources	• Rehabilitation of the affected areas based on the programs stated in the approved FMRDP. • Slopes should be re-contoured to minimize erosion and runoff. • Planting of appropriate species of vegetation and/or other species of vegetation that are environmentally acceptable. Planting initially of nurse species ***(Auri, Mangium, Crassicarpa) and to be enriched with pioneer native trees)***	100% implementation of rehabilitation and reforestation programs	EPEP Budget, FMRDF (Php 1,268,000)	EPEP, FMRDP
PEOPLE						
Construction	***PEOPLE***. Hazards, accidents	**Public Safety** *To prevent inadvertent access by the public into work areas*	Inform public of dangers of entering construction site through public consultation, liaison with the barangay/municipal leaders, display of notices and warning signs	100% implementation of Safety and Security Measures	Annual Safety Program Budget, SDMP – part of Php 10 M	
		To provide continuous and convenient access to public infra (e.g. road) To avoid disruption to people/community activities (e.g. farming)	• Pipeline construction along roads (right of way) where the local community inside Toledo Copper Mines regularly uses, should not be closed/restricted & disruption of local transport should be avoided • Safety and warning signs shall be put-up • Construction works shall not affect, disrupt or destroy agricultural/farmlands of the local community. In cases where this cannot be avoided, the farmer/tiller shall be adequately compensated	100% implementation of Safety and Security Measures		Annual Safety Program

Phase	Land Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsi-ble Party	Guarantee, MOA
Operations	***PEOPLE*** Risks, hazards and safety concerns for nearby communities	To address the nearby communities concerns and welfare	• To undertake more consultations and solicit full participation of the communities in updating of CCC SDMP • To compensate for loss of livelihood which may be affected by the project • To provide warning signs and safety devices(e.g. fencing) around Biga Pit to prevent accidental fall (of people using the peripheral road around Biga Pit which may venture into the pit's rim) • Establish and maintain an appropriate Emergency and Preparedness Response Program covering all critical areas (Malubog Dam, Biga TSF, etc.)	100% implementation of SDMP 100% implementation of Safety and Security Measures 100% implementation of Emergency and Preparedness Response Program	SDMP, Annual Safety Program, EPEP Budget (Php 100,000)	SDMP, EPEP, Annual Safety Program Budget
		To address the possibility of disastrous flooding influence by excessive discharges of Biga Pit overflow relief waters and accidental releases of tailings	• Adequate and proper compensation for loss, destroyed, damaged, farmlands, crops, properties, etc • CCC involvement in community disaster risk management initiative • Immediately conduct clean up of the affected river systems and coastal areas. Likewise, appropriate rehabilitation of the affected river and coastal areas will be implemented after the clean up; and • Affected farmers and community members will be justly compensated of their damages. • Establish and maintain an appropriate Emergency and Preparedness Response Program covering all critical areas (Malubog Dam, Biga TSF, Waste Rock Dumps, etc.)	100% compliance to agreed compensation package for affected households 100% implementation of SDMP 100% implementation of Safety and Security Measures 100% implementation of Emergency and Preparedness Response Program	SDMP, Annual Safety Program, EPEP Budget (Php 700,000)	SDMP, EPEP, Annual Safety Program Budget

Phase	Land Env Sub-Component	Potential Impact	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsi-ble Party	Guarantee, MOA
Abandonment Restoration	Land/soil, water contamination	-To return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible -to eliminate significant adverse effects on nearby water resources	• Rehabilitation of the affected areas based on the programs stated in the approved FMRDP. • Slopes should be re-contoured to minimize erosion and runoff. • Planting of appropriate species of vegetation and/or other species of vegetation that are environmentally acceptable.	100% implementation of reforestation plan/program	EPEP Budget, FMRDF of Php 21.01 M	EPEP, FMRDP

Table 4.2 **Impact Management Plan -WRDs, Carcon, Port and other Facilities**

Project Activity/ Phase	Envi Compo-nent likely to be Affected	Potential Impact	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsible Party	Guarantee, MOA
1. Pre-Construc-tion Phase	Land/Water-Acid Mine Drainage (AMD)	Effects/impacts of AMD/ARD on the environment	Planning/Design of appropriate measures and handling-management of AMD/ARD	• Observe proper dumping activities and following the design for the waste rock dump. • Establish appropriate drainage system for the runoff • Establish settling ponds on the identified locations based on the approved plan. • Regular monitoring of ground and surface water quality; • Identify water quality sampling sites for regular monitoring for the possibility of ground and aquifer contamination.	100% compliance to engineering standards and practices for the design and construction of engineered WRD landfill facility	Part of the OPEX/ ECC budget Of Php 35.3 M	ECC

Project Activity/ Phase	Envi Compo-nent likely to be Affected	Potential Impact	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsible Party	Guarantee, MOA
2. Construction Phase *Construction of Additional Carcon Sorting facility, modification/expansion of Airstrip WRD (including crushing facility) and Marcona*	Land: Soil Removal of top soil during land clearance, footings/foun-dation works for structures-facilities causes erosion, pollution, & contamination	Erosion due to expose cuts, movement of loose earth & sedimentation of waterways	**Stripping & storing of vegetation & topsoil.**- *To provide organic material & soil to assist in rehabilitation of the WRD and other areas of the Toledo Copper Mine site*	• Limit removal of trees in areas identified for development. • Proper utilization of harvested trees, i.e. Donate lumber/fire wood to affected communities. • If applicable, conduct immediate rehabilitation/revegetation of the affected areas.	100% compliance to identified measures of replanting & disposal of affected trees 100% implementation of reforestation program		EPEP, FMRDP
		Land/soil. Soil contamination	**Soil Contamination:** *-To prevent contamination of soils at the construction site site*	• Observe proper dumping activities and following the design for the waste rock dump. • Establish appropriate drainage system for the runoff • Establish settling ponds on the identified locations based on the approved plan. • Regular monitoring of ground and surface water quality;	100% compliance to engineering design plans & construction management plan 100% implementation of water quality monitoring plan		ECC, Project design/ plans
		Land/water. Pollution, contamination of water & soil	**Accidental Releases:** *-To prevent contamination of surface water & soil as a result of accidental releases of fuel/ oil*	Establish and maintain an appropriate Emergency and Preparedness Response (EPR) Program covering all critical areas (Malubog Dam, Biga TSF, Waste Rock Dumps, etc.)	100% implementation of land, air and water quality monitoring plan 100% implementation of EPR program	Part of the operational fund Of Php 68 M	ECC
	Land Use, Landscape and Visual Character	Alteration of visual character of the area due to removal of vegetation and the top soil	To preserve trees, vegetation which could be replanted and utilized for rehabilitation	• Limit removal of trees in areas identified for development. • Proper utilization of harvested trees, i.e. Donate lumber/fire wood to affected communities. • If applicable, conduct immediate rehabilitation/revegetation of the affected areas.	100% compliance to identified measures of replanting & disposal of affected trees 100% implementation of reforestation program	EPEP Budget (Php 1,628,000)	EPEP
	Land: Terrestial flora & fauna	Loss of vegetation/trees, flora	*-To minimize & compensate the loss of environmental amenity (habitat &*	• Mine-WRD rehabilitation to include planting of trees and restoration of vegetative cover	100% implementation of reforestation program		EPEP

Project Activity/ Phase	Envi Compo-nent likely to be Affected	Potential Impact	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsible Party	Guarantee, MOA
		& fauna, impacts on habitat & biodiversity	*biodiversity) from removal of vegetation*	• limit land clearing at the development area			
		Loss of Fauna/wildlife species	*-To minimize loss of species, -to protect/preserve fauna/wildlife*	To prepare a fauna management plan, that includes the following measures: • conduct fauna/wildlife inventory; fauna monitoring; return of fauna habitats to rehabilitated areas; translocation of fauna; establish a protected wildlife habitat area (We can do this by engaging third party to prepare the fauna management plan)	100% compliance to preparation and implementation of Faunal Management Plan	Part of the P5M budget for Fauna Mgt.	ECC
	Water	Soil erosion & contamination of water	*-To prevent contamination of water as a result of soil erosion*	• Observe proper dumping activities and following the design for the waste rock dump. • Establish appropriate drainage system for the runoff (to include, if applicable, cut-off drains and silt traps). • Establish settling ponds on the identified locations based on the approved plan. • Regular monitoring of ground and surface water quality;	100% compliance to engineering design plans (such as the drainage plan) & construction management plan 100% construction & maintenance of settling ponds 100% compliance to monitoring of surface water quality	Part of Drainage devt budget/ CCC Of Php 19,3M	ECC ECC
			-To prevent contamination of water as a result of accidental release of hydraulic fluid, oil or fuel from construction vehicles	Equipment wash-bays equipped with impervious surfaces and containment to capture effluent from washing operations will be established	100% maintenance & operations of wash-bays & containment facilities	Part of Drainage devt budget of (Php 105,000)	ECC
	Air	Air pollution	*-To control/minimize the generation of dust form movement of haul trucks & other heavy equipments*	• Active areas will be routinely sprayed with water in order to suppress dust. • Preservation and planting of trees, vegetation around the WRD as buffers/tree filters	100% compliance to RA 8749 100% compliance to spraying schedules	EPEP Budget (Php 9,000,000)	EPEP
	People/safety & security	Hazards, accidents	**Public Safety**	Inform public of dangers of entering quarry site through public consultation, liaison with	100% implementation of Safety & Security measures/plan	Annual Safety Program Budget, EPEP - IEC	EPEP, Annual

Project Activity/ Phase	Envi Compo-nent likely to be Affected	Potential Impact	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsible Party	Guarantee, MOA
			-To prevent inadvertent access by the public into work areas	the barangay/city leaders, display of notices/warning signs		(Php 100,000)	safety Program
2. Operations	Land	Soil and Land Use Pattern	- Loss of potential for agri & forest production (esp. food crops. *To compensate the loss for potential agri/forest production capacity*. - Loss of habitat & biodiversity. *To minimize impact & compensate loss of habitat/biodiversity* - Land use modification poses risk-danger to landslide/erosion	Participate/implement in the following: • Agricultural extension programs (provision of technical, financial assistance, etc.) • Tree planting and watershed protection/ conservation programs Provision/delineation of buffer around the WRDs, which will be a no-build/no-development activity zone/no-access zone for none-CCC personnel.	100% implementation of Rehabilitation and reforestation plans/ programs	Part of the SDMP with initial budget of P1.5M/ Project Proponent, LGU-City & Brgy. Govts.	ECC/SDMP
		Dumping of waste rocks that results to erosion & sedimentation	Erosion & Sedimentation *-To prevent transport of sediments to waterways which may result to siltation of riverbeds, streams; increase turbidity harmful to fish and other organism.*	• Observe proper dumping activities and following the design for the waste rock dump. • Establish appropriate drainage system for the runoff (to include, if applicable, cut-off drains and silt traps). • Establish settling ponds on the identified locations based on the approved plan.	100% compliance/ implementation of operational & maintenance plan of WRDs facilities	WRD devt & operational Exp. Included in the operational budget/CCC, EPEP Php 68 M	ECC
		Visual impact. *Images of degraded-disturbed landform.*	*To address visual impacts brought about by: a) incongruity in the landscape; b) perceived negative associations with mining process, dereliction and disturbance, c) restoration, d) etc*	• Observe design specifications for the waste dumps. • Reforestation/rehabilitation of the waste dumps after stabilization.	100% implementation of rehabilitation & reforestation plan/ program		ECC, EPEP
		Flora & Fauna. *Loss of vegetation, loss of habitat*	*To minimize & compensate the loss of environmental amenity (habitat & biodiversity) from removal of vegetation*	• Implementation of the Fauna Management Plan • Develop rehabilitated areas to serve as wildlife refuge/sanctuary.	100% implementation of rehabilitation & reforestation plan/ program & Wildlife/ Biodiversity Management Plan	Part of Fauna Mgt plan of P5M	ECC

Project Activity/ Phase	Envi Compo-nent likely to be Affected	Potential Impact	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsible Party	Guarantee, MOA
				• Development of corridor-escape route of wildlife from proposed WRD to sanctuary (if applicable)			
	Water-Surface	Contamination of surface watercourses due to the release of contaminated run-off of the WRD, Carcon & other facilities	*To prevent contamination of surface waters*	Installation of an efficient drainage system that will prevent surface run-off from directly going into nearby bodies of water To secure 'discharge permits' for wastewater treatment facilities/sources of water pollution	100% establishment & operations of efficient drainage system/ utilities 100% compliance to RA9275 Clean Water Act & its IRR 100% compliance to 'discharge permits' requirement/conditions	Part of drainage budget of 10M	**ECC**
		Contamination of surface watercourses through groundwater influx and ARD	*To prevent contamination of surface water as a result of groundwater influx and ARD*	• Establish appropriate drainage system for the runoff (to include, if applicable, cut-off drains and silt traps). • Establish settling ponds on the identified locations based on the approved plan.		Part of the operations plan Part of the operations plan Part of the operations plan of Php 68 M	ECC
		Contamination of water from the accidental release of hydraulic fluid, oil or fuel from mining eqpts/machineries	*To prevent contamination of water as a result of accidental release of hydraulic fluid, oil or fuel from construction vehicles*	• Establish appropriate drainage system for the runoff (to include, if applicable, cut-off drains and silt traps). • Establish settling ponds on the identified locations based on the approved plan.			ECC
	Water-Groundwater	Contamination of groundwater due to acid rock drainage (ARD) through the base or the toe of the dump.	*To prevent groundwater contamination from ARD*	• Establish appropriate drainage system for the runoff (to include, if applicable, cut-off drains and silt traps). • Establish settling ponds on the identified locations based on the approved plan.			ECC
				• Establish appropriate drainage system for the runoff (to include, if applicable, cut-off drains and silt traps). • Establish settling ponds on the identified locations based on the approved plan.		Budget for the containment & WTF facility will be dependent on the design-plan	ECC, WRMP
		Contamination of groundwater from the accidental release of hydraulic fluid, oil or fuel from mining eqpt-	Poor housekeeping, handling spills, etc. can result in contamination of surface run-off	Regular inspection of work areas will be conducted as part of a preventive maintenance program to monitor potential sources of contamination		TBD/CCC	ECC

Project Activity/ Phase	Envi Compo-nent likely to be Affected	Potential Impact	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsible Party	Guarantee, MOA
		machineries, vehicles-trucks					
	Air	Air pollution	*-to prevent the effects of air pollutants on nearby areas* *-to prevent dusts generation from dumping & wind-induced erosion of dumps*	Appropriate sprinkling in connection with dumping and by immediate rehabilitation of quarry area right after completion Secure Permit-to-operate Air Pollution Source Equipment (APSEs)	100% compliance to RA 8749 (Clean Air Act) and its IRR 100% compliance to 'Permit-to-Operate' APSE requirements & conditions 100% compliance to spraying schedules	EPEP Budget Part of Operations budget/CCC (Php 9,000,000)	EPEP
			Air Quality -to prevent contamination of air due to dust emissions fr vehicles & trucks operating on dirt roads	Water spraying will be conducted on all roads			EPEP
		Noise & Vibration	Noise and vibration caused by WRD activities disturb wildlife	Ambient Noise Monitoring be done regularly to ascertain impact on the surrounding community and environment		EPEP Budget (Php 120,000)	EPEP, ECC
	Transport Infrastructure - Land, air, water	Soil, air, water contamination	Accidents, damaged to infrastructure -to prevent soil, air and water contamination, and damaged to infrastructures	• Implement proper maintenance on all affected roads • Implement speed limits in all areas • Water spraying will be conducted on all affected roads	100% implementation of road maintenance & safety protocols	Part of the maintenance EPEP Budget (Php 9,000,000)	ECC
	Waste Management Land, air, water	Soil, air, water contamination	-To minimize production of industrial waste-scrap metal, empty containers, etc., that will be generated from WRD, Carcon, Port operations	Prepare a waste management plan, that, among others, will provide guidelines & procedures of proper waste management in various facilities/activities of the TCM	100% preparation & implementation of Waste Management Plan 100% compliance to RA 9003 (ESWM)		EPEP
			-reusable materials should be reused or recycled to reduce amount of waste generated	Establish and maintain storage areas for reusable materials; reusable materials include empty drums, timber, etc. these will be reused by the quarry, sold or donated to interested parties		EPEP Budget (Php 150,000)	Operation and Management of Location 20
			-to prevent hazardous waste from contaminating soils and water	Hazardous wastes will be stored in a secure area.	100% compliance to RA 6969 and its IRR		EPEP

Project Activity/ Phase	Envi Compo-nent likely to be Affected	Potential Impact	Impact/*Objective*	Options for Prevention Enhancement/Mitigation Measures	Target Efficiency	Cost/Responsible Party	Guarantee, MOA
	People	• Risks, hazards and safety concerns for nearby communities • Loss of livelihood for affected farmers	To address the nearby communities concerns and welfare	• To undertake consultations and solicit full participation of the communities in updating of CCC SDMP • To compensate for loss of livelihood which may be affected by the project • Provision/delineation of buffer around the Marcona WRD, which will be a no-build/no-development activity zone/no-access zone for none-CCC personnel. Houses & public facilities within the buffer zone shall be relocated.	100% compliance/ implementation of the SDMP	SDMP, Initial budget of P2.5M	SDMP
3. Abandonment Restoration	Land, Water	Land/soil, water contamination	-To return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible -to eliminate significant adverse effects on nearby water resources	• Rehabilitation of the affected areas based on the programs stated in the approved FMRDP. • Slopes should be re-contoured to minimize erosion and runoff. • Planting of appropriate species of vegetation and/or other species of vegetation that are environmentally acceptable.	100% compliance to rehabilitation & reforestation program and the provisions of the FMRDP	EPEP Budget, FMRDP (Php 21,010,000)	EPEP, FMRDP

Table 4.3 **Environmental Monitoring Plan (EMoP) and other Monitoring Modes**

Key Environmental Aspects per Project Phase	Potential Impacts per Env Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
1. CONSTRUCTION PHASE													
Clearing of Vegetation & earthmoving	Loss of Habitat	Reforestation/ rehabilitation success-survival rates & re-colonizaiton of wildlife	Periodic inventory of planted seedlings Survival, growth rate computations	Sem-annually	Progressively rehabilitated areas	PCO, forester, envi unit	Approx PhP 100,000/ hectare	Decline (~10%) in the abundance, frequency and distribution of vegetation	Evident decline (~15%)	Highly evident decline (~20%)	Investigate possible cause of the observed decline in the parameters being monitored	Investigate & implement measures to address decline Improve rehabilitation measures	Report/ coordinate with MMT, DENR, review & improve-enhance rehabilitation reforestation meausres
	Erosion-landslide, mass movement	Mass movement, geologic failure	Direct visual observation	Daily during heavy const works and weekly or daily as const works taper	Project and neighboring areas	Geology Department	₱50,000/ yr	Light-moderate movement of debris & rocks almost reaching the buffer/ easement areas	Movement of debris rocksbrbreaching the buffer easement area		See EMP/IMP	Stop activity causing erosion, implement remedial measures more than EMP	
1.1 Air Quality-Generation of Airborne Dust	Increase in TSP in the Atmosphere	$PM_{2.5}$	Gravimetric Method	Quarterly	Barangay Biga and Sigpit Area	CCC Environment Department	₱240,000/yr	40 ug/NCM		50 ug/NCM	See EMP/IMP		Increase frequency of EMP/measures
		TSP	Gravimetric Method	Quarterly	Barangay Biga and	CCC Environmen	₱40,000/ yr	175 ug/NCM		230 ug/NCM	See EMP/IMP		Increase frequency

Key Environmental Aspects per Project Phase	Potential Impacts per Env Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
					Sigpit Area	t Department							of EMP/measures
1.2 Noise	Increase of ambient noise levels	Decibel (dB) for Industrial Areas	Digital Noise Monitoring Equipment	Quarterly	Barangay Biga and Sigpit Area	CCC Environment Department	₱30,000/yr	50 dB (Daytime)		65 dB (Daytime)	See EMP/IMP		Limit/decrease noise generating activities
1.4 Water	Ground water contamination	pH, mercury, Lead, Iron, Copper, Cadmium, Arsenic, Cyanide as Free, Sulfate and Nitrate	Grab Sampling	Once a month	Barangay Biga	CCC Environment Department	₱250,000/yr	75% of limit value in the Philippine National Standard for Drinking Water (PNSDW)		PNSDW Standard Limit Value	See EMP/IMP		Implement enhancement and improve corrective measures
	Surface water contamination	pH	Grab Sampling	Once a month	Yogyogan River, Malubog Dam and Guinguiotan River	CCC Environment Department	₱250,000/yr	4.0		6.0-9.5	See EMP/IMP		Implement enhancement and improve corrective measures
2. OPERATION PHASE													
2.1 Air Quality-Generation of Airborne Dust	Increase in TSP in the Atmosphere	$PM_{2.5}$	Gravimetric Method	Quarterly	Barangay Biga and Sigpit Area	CCC Environment Department	₱240,000/yr	40 ug/NCM		50 ug/NCM	See EMP/IMP		Increase frequency of EMP/measures
		TSP	Gravimetric Method	Quarterly	Barangay Biga and Sigpit Area	CCC Environment Department	₱40,000/yr	175 ug/NCM		230 ug/NCM	See EMP/IMP		Increase frequency of EMP/measures

Key Environmental Aspects per Project Phase	Potential Impacts per Env Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
2.2 Noise	Increase of ambient noise levels	Decibel (dB) for Industrial Areas	Digital Noise Monitoring Equipment	Quarterly	Barangay Biga and Sigpit Area	CCC Environment Department	₱30,000/yr	50 dB (Daytime)		65 dB (Daytime)	See EMP/IMP		Limit/decrease noise generating activities
2.3 Land-Topography and Soil	Erosion-landslide, mass movement	Mass movement, geologic failure	Direct visual observation	Once a month	Project and neighboring areas	Geology Department	₱50,000/yr				See EMP/IMP		Stop activity causing erosion, implement remedial measures more than EMP
2.4 Water	Ground water contamination	pH, mercury, Lead, Iron, Copper, Cadmium, Arsenic, Cyanide as Free, Sulfate and Nitrate	Grab Sampling	Once a month	Barangay Biga	CCC Environment Department	₱250,000/yr	75% of limit value in the Philippine National Standard for Drinking Water (PNSDW)		PNSDW Standard Limit Value	See EMP/IMP		Implement enhancement and improve corrective measures
	Surface water contamination	pH	Grab Sampling	Once a month	Yogyogan River, Malubog Dam and Guinguiotan River	CCC Environment Department	₱250,000/yr	4.0		6.0-9.5	See EMP/IMP		Implement enhancement and improve corrective measures

PART 5 IEC IMPLEMENTATION AND SOCIAL DEVELOPMENT PLAN

INFORMATION, EDUCATION AND COMMUNICATION PLAN

Stakeholder Involvement

Stakeholder identification. Stakeholders are those entities that have environmental stake in the mining project or are to be potentially affected by the mining operation and closure process. These stakeholders are categorized into three (3) groups, namely: company, community, and the government (both local and national). Developing a good relationship with them is key to a smooth and successful final mine rehabilitation and decommissioning process.

These stakeholder groups will be actively involved in the formulation of this FMRD Plan and the subsequent implementation of the program. Their involvement in the planning process enables the company to integrate their aspirations with regards to the final land use and the corresponding rehabilitation and decommissioning strategies that will be employed by the company.

Below are the key stakeholder groups under three (3) broad categories considered and will be actively involved in the planning process and program implementation:

- The Company. This category includes the CCC management, ACMDC management, and employees union through the PAMCC or any other recognized organization of CCC employees.
- The Community. Present CCC operations primarily cover four (4) impact barangays of Toledo City, namely: Don Andres Soriano in the south, Media Once in the west, Biga in the north, and Loay in the east. The Local Government Units (LGUs) administering these barangays are to be represented by their respective Barangay Captains or any official designated by the Barangay Captain in his lieu. Existing Peoples Organizations (POs) in these barangays which are being organized or mobilized and tapped by CCC under its Social Development and Management Program (SDMP) will be included also in the consultation process.
- The Government. Identified key groups under this stakeholder category include the City Government of Toledo for the local government; the Department of Environment and Natural Resources, Region 7 (DENR-&) through the Community Environment and Natural Resources Office (CENRO) in Toledo City; Mines and Geosciences Bureau, Region 7 (MGB-7); and the Environmental Management Bureau, Region 7 (EMB-7).

Stakeholder Consultations. Stakeholder consultations will ensure that the public, specifically mine affected communities and other parties which have a stake in the project and the post-mining land use, are adequately involved in the project from the outset. They will be given the opportunity to actively participate and contribute to the planning process so that formulated strategies or program of action are reliable and acceptable by a consensus. In accordance with the guidelines, presentation of the final draft of the Final Mine Rehabilitation and Decommissioning Plan (FMRDP) was presented to identified directly impacted barangays, namely Barangay Don Andres Soriano, Biga, Loay and Media Once.

Public meetings or round table discussions will form the essence of these stakeholder consultations. These are intended to record and address specific issues and concerns to the satisfaction of both CCC/ACMDC and the rest of the stakeholder groups. During said consultations, the proposed final landuse of the mine site and rehabilitation strategies to be employed were presented to the stakeholder groups, mainly the barangay council members. Issues and concerns raised by the stakeholders were properly noted, discussed and integrated the revision of the FMRD Plan.

During the revision of this plan (if need arises), this process will also be applied. To achieve an effective consultation process, listening, feedbacking, and informing mechanisms will be employed.

The formulation of the IEC plan will have to consider its importance as to the following:

- **To raise the level of the public's awareness**
- **To enable the company to be transparent**
- **To solicit cooperation and active involvement of the community to Toledo Copper Mine's programs and projects (e.g. SDMP; Community-Based Riparian Management Plan & Reforestation Program, etc.)**
- **To communicate results of the various monitoring and studies conducted that would have an impact on the community and the environment**

The company take every opportunity to raise public awareness and promote responsible mining in all facets of its operation. Among its various strategies is the holding of its own activities and participation in different programs in partnership with different stakeholders. Our information, education and communication initiatives to promote responsible mining through the use of different medium and forum.

In preserving its cultural heritage, the company open it doors of the Carmen Copper Heritage Center, the first copper mining museum in the country. It will be a repository of the rich cultural heritage of mining in Toledo City and an educational center for responsible mineral resource development.

The Company has also assisted its host and neighboring communities in activities which safeguards existing socio-cultural values to promote social cohesion and cultural awareness, and to instill community pride among the community members. These include fiesta celebrations, religious activities, special commemorations and other socio-cultural events.

With these programs in place, Carmen Copper will continuously endeavor to be a role model for sustainability and responsible mining, and ensure that the benefits from its operations accrue to as many people as possible within its host and neighboring communities and to the nation as a whole.

Table 5.1 IEC Framework

Target Sector Identified as needing Project IEC	Major Topic/s of concern in Relation to Project	IEC Scheme/ Strategy/Methods	Information Medium	Indicative Timelines And Frequency	Indicative Cost
1. Brgy Biga Bagong Buhay (4 B) Multipurpose Cooperative	Sustainable farming system, Empowerment on crafting responsive development program	Formal and focus group discussion (FGD)	Participatory Rapid Appraisal (PRA)	Semi Annual	30,000.000
2. Mabais Mabais Biga Rural Workers Assn (MABIRWA)	Sustainable farming system, Empowerment on crafting responsive development program	Formal and focus group discussion (FGD)	Participatory Rapid Appraisal (PRA)	Semi Annual	30,000.000
3. Religious, Academe, POs, Associations, Cooperatives and LGUs.	Project Development and expansion of tailing storage facility	Sectoral representation in formal gathering	Project and Public hearing	January 19, 2018 and April 6, 2018	20,000.00
4. Religious, Academe, POs, Associations, Cooperatives and LGUs.	SDMP planning	Sectoral representation in formal gathering	SDMP consultations	2 days done annually	36,000.00

Table 5.2 Social Development Program (SDP) or Community Assistance Program (CAP)

Name of Activity	Date	Venue	Description of Activity	Target Beneficiaries	No of Beneficiaries	Type of Activity	Value/Cost
1. Livelihood	2016	Brgy Biga	Provision of planting materials such as seeds, fertilizers, tools and Swine production	Brgy Biga Bagong Buhay (4 B) Multipurpose Cooperative	140	Farming	400,000.00
2. Livelihood	2017	Brgy Biga	Propagation of endemic fruit trees	Brgy Biga Bagong Buhay (4 B) Multipurpose Cooperative	140	Seedling production	171,420.00
3. livelihood	2016	Brgy Biga	Provision of planting materials such as seeds, fertilizers and tools	Mabais Mabais Biga Rural Workers Assn (MABIRWA)	25	Farming	108,550.00
4. Livelihood	2016	Brgy Bagacay	Provision of planting materials such as seeds, fertilizers, tools and swine production	Bagacay Farmer Association	180	Farming	148,800.00
5. Education	2012	Brgy Biga	Construction of 3 classroom	Biga Elem School	444	Facility improvement	3,600,000.00
6. Education	2014	Brgy Biga	Provision of school supplies	Biga Elem School	444	Support to education	100,000.00
7. Education	2017	Brgy Biga	Construction of 4 classroom Integrated High School	Biga Elem School	444	Facility Improvement	6,162,236.00
8. Feeding	2014-2018	Brgy Buga	Purchase of goods required on feeding activities	Biga Elem Scholl	444	Support to Education	500,000.00
9. Education	2016	Brgy Bagacay	Construction of 1 classroom and perimeter fence	Bagacay Elem School	288	Facility Improvement	1,200,000.00
10. Water System	2016	Brgy Biga	Construction of water reservoir and installation of water pump and distribution lines	Brgy Biga	2,829	Level 2 water system	6,700,000.00
11. Health care	2016	Brgy Biga	Construction of birthing center and senior citizen office	Brgy Biga	2,829	Health center	2,300,000.00
12. Health care	2016-2018	Brgy Biga	Free medical consultation and medicine	Brgy Biga	2,829	Medical Mission	300,000.00
13. Cultural tradition	2017	Brgy Biga	Gasa sa Mina activities	Brgy Biga	384	Bundle of Joy	172,800.00

PART 6 INSTITUTIONAL PLAN

Carmen Copper Corporation (CCC) as the organization managing the Toledo Copper Mines, is complete with an organizational structure with a set of institutional policies to manage the company effectively, efficiently and to attain its desired objectives.

Backgrounder on Toledo Copper Mines/CCC Organizational Structure

Management Structure. The mine management structure has been organized with the objective of minimizing layers of management to facilitate communications and maintain flexibility. Beyond the Resident Manager, and Divisional Manager levels, the overall management structure consists of the following levels: Department Managers, Section Managers, and Unit (front line) Managers. Each level has been designed to generally have between four to eight supervisors reporting to the next higher management level. Managers, including the Resident Manager, will reside on site in the existing housing facilities to the greatest extent possible. In practical terms, management staff will then be immediately available to respond to any situation that requires their attention on a 24-hour basis.

In a typical production year at 15.2 million metric tonnes, the mine is forecast to employ 443 managerial staff and 3,012 rank and file staff for a total of 3,455 personnel.

Divisions. The overall control of operations is broken down into twelve functional areas. These groups are: Underground Mining, Ore Processing, Personnel (HRM) and Administration, Geology and Surface Maintenance and Services Group, Finance (Comptroller), Safety and Environment, Purchasing, Sangi Port & Quality Assurance, Medical Facilities and Security.

The Underground Mining, Ore Processing, Surface Mines, Finance and Human Resource areas headed by Divisional Managers who report directly to the Resident Manager. The other functional areas are headed by Departmental Managers who in some cases report directly to the Resident Manager. Reporting to these functional area managers are department heads and/or superintendents.

Once development and operations resume, each Divisional Manager will have both the authority and responsibility to maintain and support the business plan by active participation and direction in the planning and budgeting for his respective area.

Safety and environment. To emphasize the importance of safety in the organization, the Safety and Environment Head will report directly to the Resident Manager. A comprehensive safety program which includes programs for ongoing safety training during operations, regular inspections of workplaces, safety orientation for new employees, and underground evacuation drills will be implemented. Safety will be maintained to high international standards. During the rehabilitation phase, the mine will provide safety inspection oversight to contractor activities.

Within the context of this EPRMP, Toledo Copper Mines 'Institutional Plan' should encompasses the following:

- An organizational [institutional] structure that considers the company's linkage with entities outside of the company – local governments, NGOs, People's Organization, local community, etc.
- Arrangements through mutual agreements, MOAs, MOUs with such entities as the Multi-partite Monitoring Team (MMT), Sapangdaku River Council, barangay councils (through resolutions, etc.)

The 'institutional plan' should also relate/linked to the SDMP, for the SDMPs successful and effective implementation.

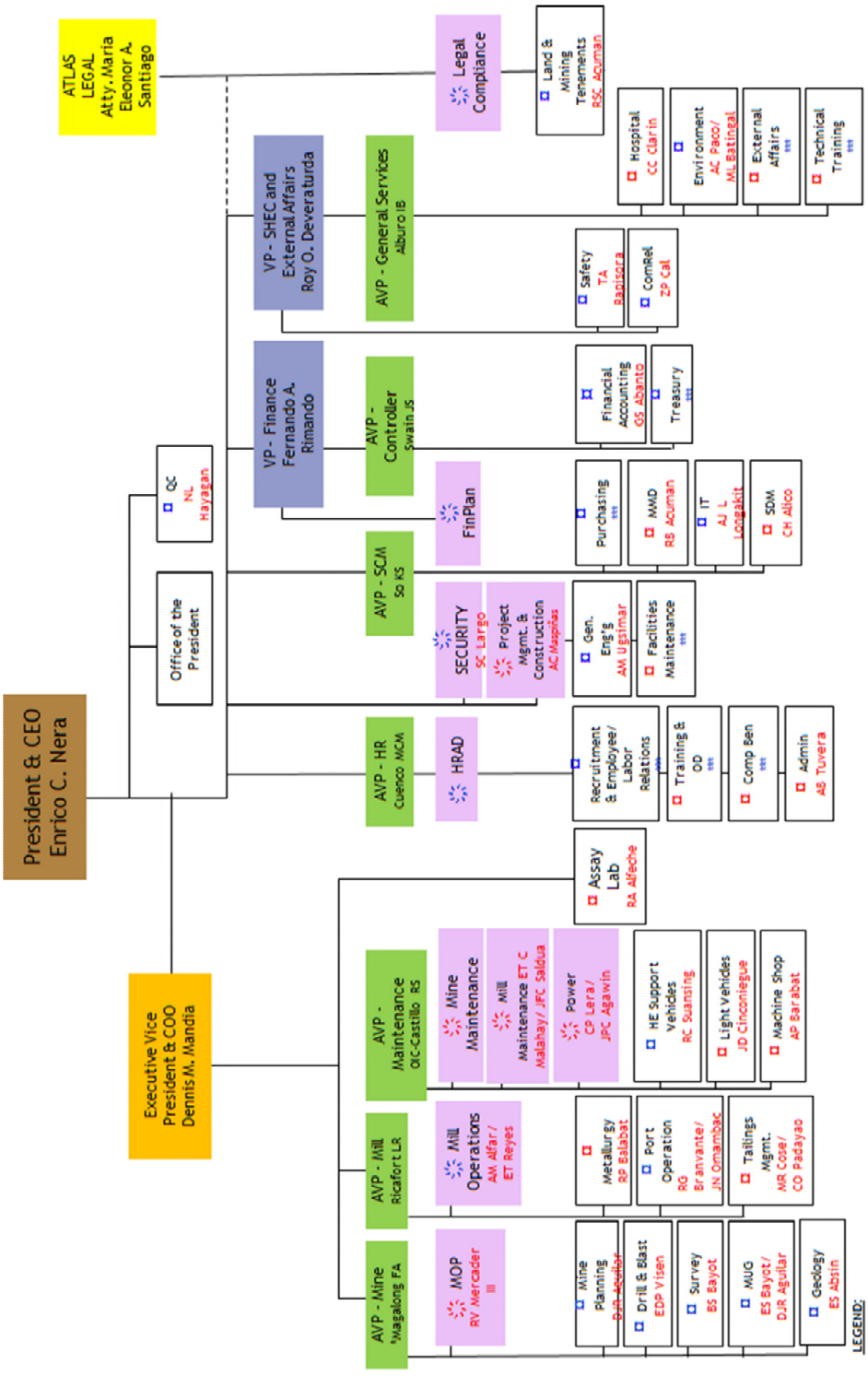
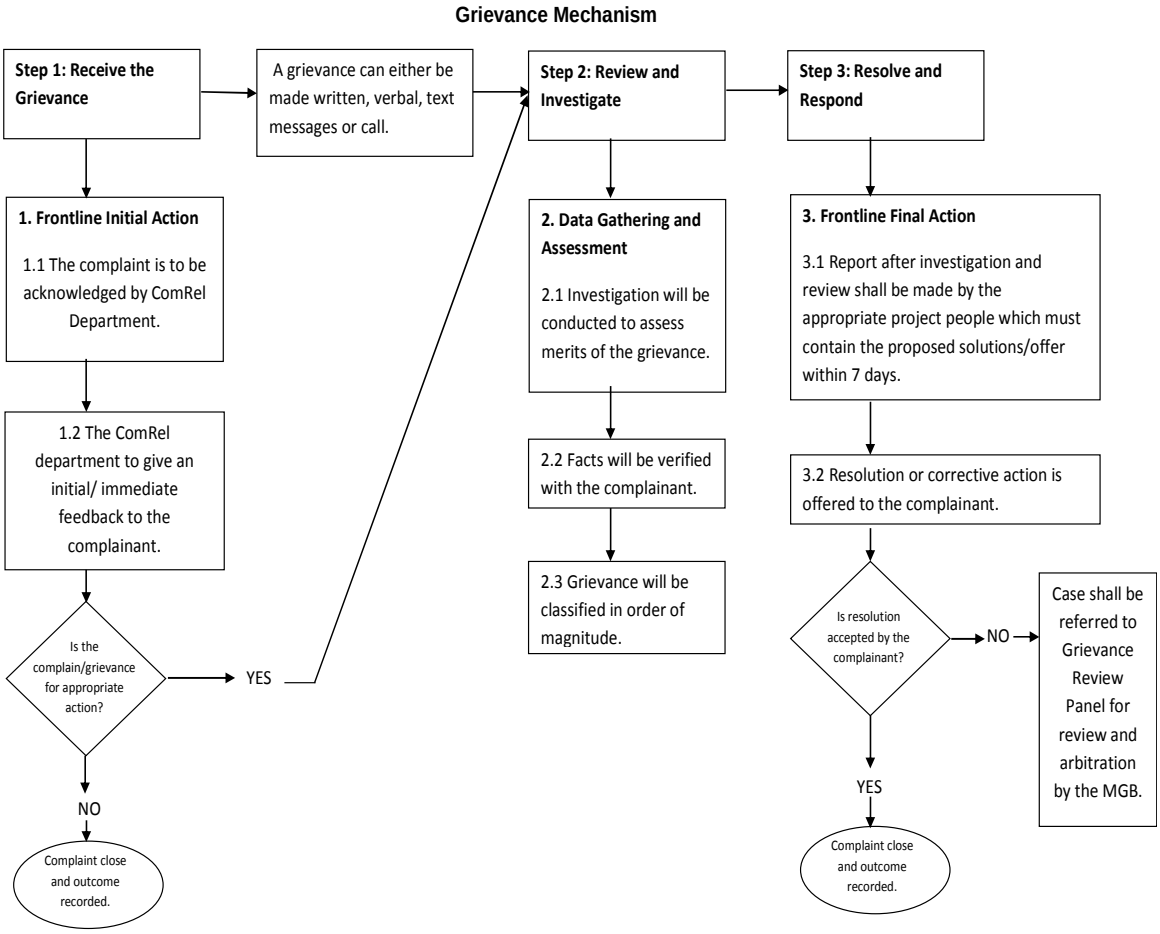


Figure 6.1 Organizational Chart

Grievance and Redress Mechanism

What is Grievance? - A grievance is a formal complaint regarding an incident that has happened in relation to the project in which the community feels the need to be addressed. This is very important to ensure all legitimate concerns and complaints are properly addressed and resolved, to apply international guidelines, standards and best practices to enhance relations with the community, to have a simple and quick process for people to be able to inform the Project of their concerns and complaints, and to build confidence and trust between the community and the Project.


Grievance Mechanism
Step 1: Receive the Grievance
A grievance can either be made written, verbal, text messages or call.
Step 2: Review and Investigate
Step 3: Resolve and Respond
1. Frontline Initial Action
1.1 The complaint is to be acknowledged by ComRel Department.
1.2 The ComRel department to give an initial/ immediate feedback to the complainant.
Is the complain/grievance for appropriate action?
YES
NO
Complaint close and outcome recorded.
2. Data Gathering and Assessment
2.1 Investigation will be conducted to assess merits of the grievance.
2.2 Facts will be verified with the complainant.
2.3 Grievance will be classified in order of magnitude.
3. Frontline Final Action
3.1 Report after investigation and review shall be made by the appropriate project people which must contain the proposed solutions/offer within 7 days.
3.2 Resolution or corrective action is offered to the complainant.
Is resolution accepted by the complainant?
NO
Case shall be referred to Grievance Review Panel for review and arbitration by the MGB.
YES
Complaint close and outcome recorded.

PART 7 FINAL LAND USE MANAGEMENT PLAN

The waste rock dumps, tailings covered areas, mined-out areas, and other waste areas which are not covered with topsoil prior to planting shall initially revert back to at least a vegetated area with grasses/shrubs or monocropped forest tree plantation within at least 5 years after mine closure. Progressive enrichment planting during mine life and natural succession after mine closure will facilitate approaching of the tree plantation/revegetated areas into a diverse forest and with natural recruitment of wildlife species. The use of such areas for grazing, agriculture, or fruit tree orchard purposes are to be discouraged if no proof that non-bioaccumulation of heavy metals by plants occurs.

Other areas not covered by above types shall either revert back to agricultural and grazing lands (for slopes less that 18%) or a forest with diverse species, preferably of indigenous species, which are set aside for strict protection purposes owing to the nature of the area (i.e., environmentally critical as determined by government stakeholder groups such as the DENR). Proposed final land uses may be amended as this plan is revised.

Below are the proposed/planned final land uses indicated in TCMs FMRDP :

- Strict forest protection zone – area revegetated primarily with fast-growing exotic plant species and some indigenous forest tree species applicable and recommended as may be the results of the soil amelioration and bioremediation R&D. Enrichment planting activities throughout the rehabilitation period will also be initiated to increase diversity. Fauna habitat establishment and management shall also form part of this zone management;
- Production forest zone – area revegetated with fast-growing, exotic forest tree species with good coppicing ability (for fuelwood production) or thoroughly maintained for timber production purposes and/or area planted with species for biofuel production purposes. These are to be sustainably managed under a viable comanagement schemes or through issuance of appropriate tenurial instrument;
- Food production zone – area, not directly affected by mining and presently utilized for farming by existing informal settlers, shall be used for production of agricultural cash crops or high value crops, fruit tree orchards, if not, for use as pastureland/graze land purposes; and
    - Ecotourism area managed under a viable co-management scheme.

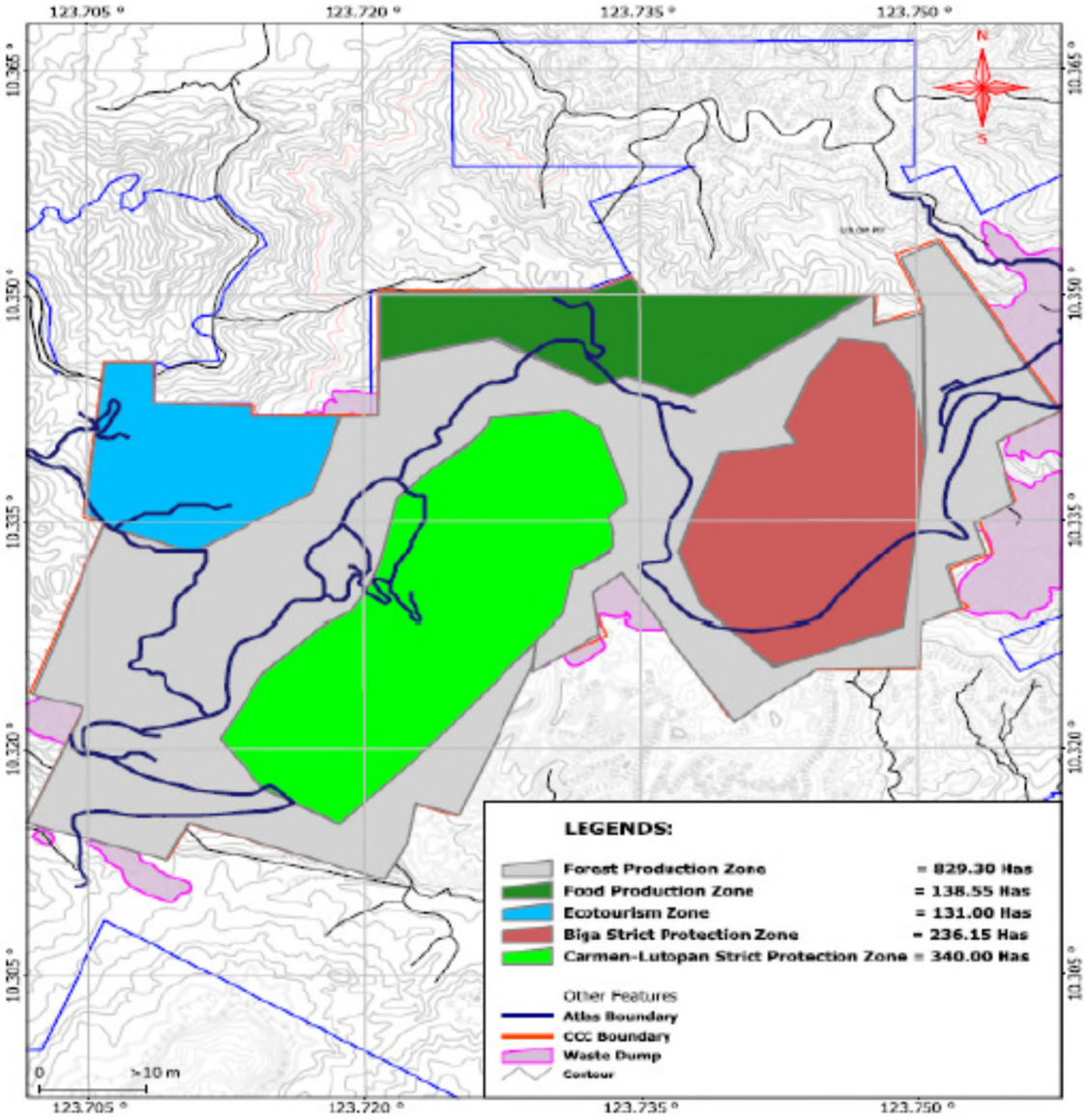


Fig. 7.1 Proposed General Final Mine Land Use Plan of CCC.

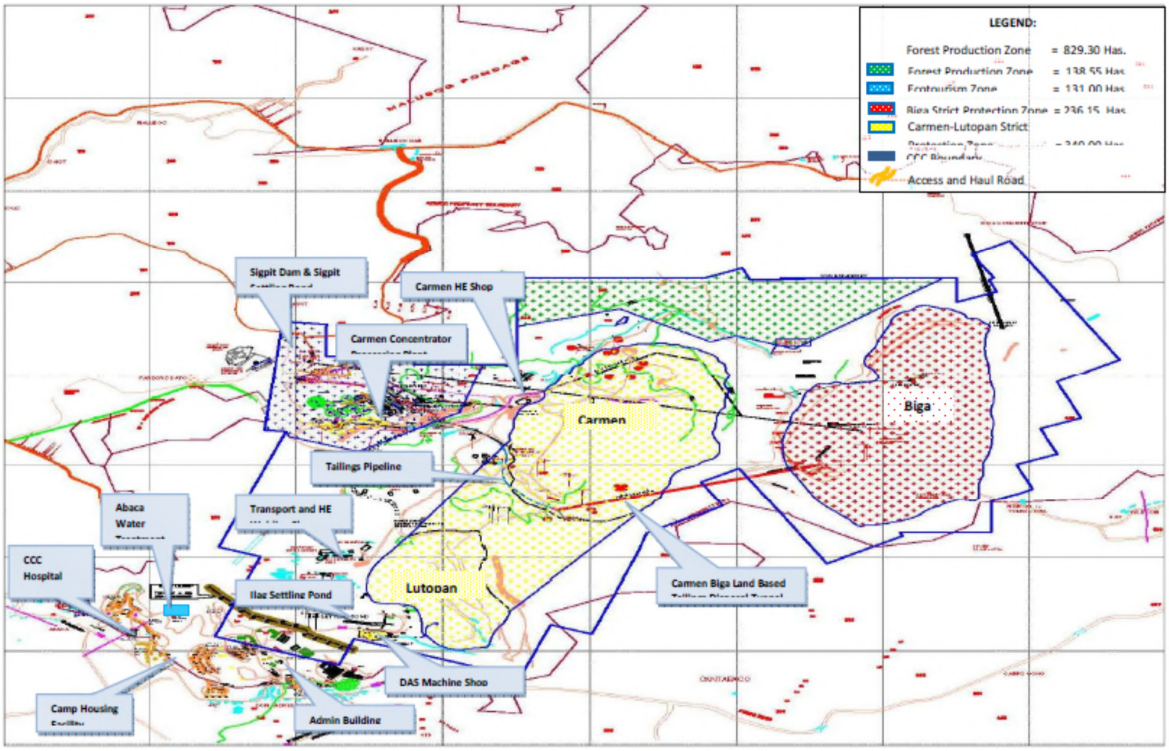


Fig. 7.2 Proposed Final Mine Land Use Plan overlayed with facilities

PART 8 PROJECT ENVIRONMENTAL MONITORING AND AUDIT PRIORITIZATION SCHEME

Project Name :	**Toledo Copper Mines Mining and Processing Operatioins**
ECC Reference No. :	
Project Location :	**Brgy. Big, Toledo City**
Proponent :	**Carmen Copper Corporation**
Pollution Control Officer :	Cristopher John W. Salcedo
Tel. No./Fax No./E-mail :	
Project Type:	**EPRMP**
Project Status :	**The application for ECC Amendment is on-process with the submission of the EPRMP Study (main report)**

I. PROJECT CONSIDERATIONS

1.1 Size and Type

1.1.1 Size based on number of employees

Specify number of employees: 40 (during construction stage)

1.1.2 Type

ECP (in either ECA or Non-ECA)

Non-ECP but in ECA

Non-ECP and Non-ECA

1.2 Waste Generation and Management

1.2.1 Enumerate Waste Type and Specify Quantity of Wastes generated in your facility. (Identify /Enumerate)

Category	Waste	Type		Quantity (MT-m3/yr)
		Hazardous	Non-Hazardous	
Air	1	Exhaust emissions from vehicles, eqpt,,		Undetermined
	2		Dusts from open areas (TSF and WRD site and dirt access roads)	Undetermined
Liquid	3		Storm water run-off (erosion, sedimentation)	Undetermined
	4	Acid Rock Drainage	Drainage/Stormwater run-off	Undetermined
	5	Spilled Oil lubricants from heavy equipments, machineries		Undetermined
	6		Biga TSF Water Relief/Overflow	17T cu.mt
Solid	7		Domestic sources -Cans, containers, papers, plastics, food wastes, etc.	Undetermined
			Trees, plant trimmings, leaves, etc.	Undetermined

1.3 Pollution Control System (PCS)

1.3.1 Enumerate PCS or Waste Management Method Used in your facility. (Identify /Enumerate)

Category	PCS/Waste Management Method Used	Remarks

Air	Water spraying	
	Trees, greeneries as buffers	
Liquid	Drainage sys., siltation/containment pond, berms, bunds, buffers, vegetative cover	For stormwater run-off
	Decant, Lime Injection, Sedimentation/ WTF	For Biga TSF Water Relief/overflow
Solid	MRF, composting,	

II. PATHWAYS

2.1 Prevailing wind towards barrio or city? (mark the corresponding point) generally *No .*
2.2 Rainfall (impacts surface & groundwater pathways)
2.2.1 Average annual net rainfall:
Specify amount: (units: mm)
2.2.2 Maximum 24-hour rainfall:
Specify amount: (units: mm)
2.3 Terrain (select one and mark) ***rugged***
2.4 Is the facility located in a flood-prone area? (select one and mark)
2.5 Ground Water
Depth of groundwater table (meter) (select one and mark). *TBD*
0 to less than 3
3 to 10
Greater than 10

III. RECEIVING MEDIA/RECEPTORS

3.1 Air (Distance to nearest community) (select one and mark)
0 to less than 0.5 km
0.5 to 1 km
Greater than 1 km
3.2 Receiving Surface Water Body
3.2.1 Distance to receiving surface water: (select one and mark)
0 to less than 0.5 km
0.5 to 1 km
Greater than 1 km (From Biga TSF to Lower Sigpit Creek Outfall)
3.2.2 Size of population using receiving surface water
Specify number:
3.2.3 Fresh Water
3.2.3.1 Classification of fresh water (select one and mark)
AA
AB
CD
3.2.3.2 Size of fresh water body
Specify size: (units: km2)
3.2.3.3 Economic value of water use (may select more than one of the criteria below)

Drinking
Domestic
Recreational
Fishery
Industrial

Agricultural

3.2.4 Salt water

3.2.4.1 Classification of salt water (select one and mark)

SA
SB
SC
SD

3.2.4.2 Economic value of water use (may select more than one of the criteria below)

Fishery
Tourist zone or park
Recreational
Industrial

3.3 Ground Water

3.3.1 Distance to nearest recharge area (select one and mark)

0 to less than 0.5 km
0.5 to 1 km
Greater than 1 km

3.3.2 Distance to nearest well used (select one and mark)

0 to less than 0.5 km
0.5 to 1 km
Greater than 1 km

3.3.3 Groundwater use within the nearest well (may select more than one of the criteria below)

Drinking
Industrial
Agricultural

3.4 Land

3.4.1 Indicate current/actual land uses within 0.5 km radius: (may select more than one of the criteria below)

Residential
Commercial/Institutional
Industrial
Agricultural/Recreational
Protected Area

3.4.2 Potential/proposed land uses within 0.5 km (may select more than one of the criteria below)

Residential
Commercial/Institutional
Industrial
Agricultural/Recreational
Protected Area

3.4.3 Number of affected Environmentally Critical Areas within 1 km:

Specify number:

3.4.4 Distance to nearest ECA (select one and mark)

0 to less than 0.5km
0.5 to 1 km
Greater than 1 km

IV. ENVIRONMENTAL PERFORMANCE (FOR EXISTING PROJECTS FOR EXPANSION)

3.5 Compliance (pls. take note that this will be double-checked with PCD files)

Law	Violation (check if any)	Type (pls specify number of times committed) STANDARD				Type of Admin Violation	Additional Remarks/Status of Compliance
		Emission/Effluent/ Discharge	Ambient	Human Impact	Admin/ECC		
RA 8749							
RA 9275							
RA 6969							
PD 1586							
RA 9003							

3.6 Number of Valid Complaints

3.6.1 Citizen and NGOs

Specify number:

3.6.2 Others (other Govt. Agencies, Private Institutions)

Specify number:

==========

(To be filled up by EMB Personnel)

RECOMMENDATION/S:

_____

_____

_____

_____

_____

Assessed By:

Noted By:

SWORN STATEMENT OF ACCOUNTABILITY OF THE PROPONENT

This is to certify that all the information and commitments in this Environmental Impact Statement (EIS) are accurate and complete to the best of my knowledge.

By the authority vested in me as the President & CEO of the **Carmen Copper Corporation's Toledo Copper Mines Integrated Mining and Processing (Mine to Port) Operations located at Barangay Don Andres Soriano, Toledo City** –I hereby commit to ensure implementation of all commitments, mitigating measures and monitoring requirements indicated in this Environmental Performance Report and Management Plan (EPRMP) as well as the following:

- Conform to pertinent provisions of applicable environmental laws e.g., R.A. No. 6969 (*Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990*), R.A. No. 9003 (*Ecological Solid Waste Management Act of 2000*), R.A. No. 9275 (*Philippine Clean Water Act of 2004*), and R.A. No. 8749 (*Philippine Clean Air Act of 1999*).
- Abide and conform with LGU development plans and guidelines.
- Promptly pay local taxes and other financial obligations.
- Regularly submit reports to concerned agencies.

I hereby bind myself to answer any penalty that may be imposed arising from any misrepresentation or failure to state material information in this EPRMP.

In witness whereof, I hereby set my hand this ____ day of MAY 30 2022 at TOLEDO CITY.

ALEXEI JEROME G. JOVELLANA
President and CEO

SUBSCRIBED AND SWORN TO before me this ____ day of MAY 30 2022 2022, affiant exhibiting his/her Philippine Passport No. P6857916A issued on _____ at _____, Philippines

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Book No. 13
Series of 2022

OLIVER E. BAYLOSIS
Notary Public
City of Toledo & Province of Cebu
Specifically for the Municipalities of Balamban, Asturias, Tuburan, Tabuelan, Pinamungajan & Aloguinsan
Until December 31, 2023, Not. Com. No. 91-2022-T
Admin., Bldg., Carmen Copper Corp.
Brgy. Don Andres Soriano, Toledo City, Cebu
PTR No. 3382569/1/11/22/Toledo City, Cebu
IBP No. 012097/Lifetime/Cebu Province
Roll of Attorney's No. 5[illegible]

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ANNEX

ANNEX 1: Operating Agreement

OPERATING AGREEMENT
(TOLEDO MINE RIGHTS, FIXED ASSETS AND SURFACE RIGHTS)

This Operating Agreement made and entered into on this 5th day of May 2006 by and between:

ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION (hereinafter "Atlas"), a corporation duly organized and existing under and by virtue of the laws of the Republic of the Philippines, with principal office at the 7th Floor, Quad Alpha Centrum Building, 125 Pioneer Street, Mandaluyong City, represented in this act by its Executive Vice President and Director, Mr. Martin C. Buckingham;

- and -

CARMEN COPPER CORPORATION (hereinafter "CCC"), a corporation duly organized and existing under and by virtue of the laws of the Republic of the Philippines, with principal office at the 7th Floor, Quad Alpha Centrum Building, 125 Pioneer Street, Mandaluyong City, represented in this act by its Chairman and President, Mr. Alfredo C. Ramos.

(Atlas and CCC shall hereunder be each referred to as a "Party" and collectively as the "Parties".)

WITNESSETH THAT:

RECEIVED
JUN 9 2006
10:15 AM

WHEREAS, Atlas agrees to convey to CCC its Exploration (as hereafter defined), Development (as hereafter defined), and Utilization (as hereafter defined) rights under certain mining rights and claims which are more particularly described in Annex I (collectively referred to herein as the "Toledo Mine Rights") and the right to rehabilitate, operate and/or maintain certain of its Fixed Assets (as hereafter defined) and certain Surface Rights (as hereafter defined).

WHEREAS, CCC desires to undertake the rehabilitation, improvement, operation and/or maintenance of the Fixed Assets and the Surface Rights, and the Development, Utilization and Productive Operation over the Contract Area covered by the Toledo Mine Rights (the foregoing activities are collectively referred to herein as the "Toledo Mining Project").

WHEREAS, CCC has the technical and financial capacity to undertake the Toledo Mining Project.

WHEREAS, the Parties have agreed that the production and marketing of the Marketable Product (as hereafter defined) from the Toledo Mining Project, as well as

all the proceeds thereof, shall pertain solely to and be under the full control of CCC; on the other hand, Atlas will receive royalty fees in consideration for the conveyance to CCC of certain rights of Atlas over the Toledo Mine Rights, the Fixed Assets and the Surface Rights under this Agreement.

NOW, THEREFORE, for and in consideration of the foregoing premises, and of the mutual covenants, warranties, agreements, understandings and conditions hereinafter set forth, Atlas hereby conveys, transfers and delivers to CCC the possession, occupancy, use and enjoyment of the Toledo Mine Rights, the Fixed Assets and the Surface Rights for the purpose of undertaking, operating and carrying out the Toledo Mining Project under the following terms and conditions:

DEFINITION OF TERMS

In this Agreement, the words and expressions defined below shall have the meanings assigned to them except where the context requires otherwise:

"Agreement" means this Operating Agreement together with all the Annexes hereto, each of which is an integral part of the Agreement, as the same may be amended from time to time in accordance with the terms hereof;

"Contract Area" means the area delineated as such under Annex II for Exploration, Development and Utilization of minerals under the Toledo Mine Rights;

"Development" means the work undertaken to explore and prepare an ore body or a mineral deposit for mining, including the construction of necessary infrastructure and related facilities;

"Disclosure Statement" means the disclosure statement attached hereto as Annex VII;

"Exploration" means the searching or prospecting for mineral resources by geological, geochemical or geophysical surveys, remote sensing, test pitting, trenching, drilling, shaft sinking, tunneling, or any other means for the purpose of determining the existence, extent, quantity and quality thereof and the feasibility of mining them for profit;

"**Exploration Permit**" means the permit to be issued by the relevant regulatory authority to enable the relevant Party to exercise its Exploration rights;

"Fixed Assets" means those assets described in Annex III hereof;

"Inventory" means the machinery, equipment, spare parts, supplies and materials purchased or acquired by CCC and kept in stock for subsequent installation and/or use in the Toledo Mining Project in accordance with this Agreement;

"Malubog Dam" means the dam declared in the name of Atlas under Tax

appoints CCC as its Attorney-in-Fact, with full power of substitution, for or on its behalf, as well as Atlas' successors-in-interest and assigns (i) to do and perform all acts and deeds necessary to exercise all of the Toledo Mine Rights and its other rights to the Contract Area under the terms of this Agreement; (ii) to execute, sign, file and deliver all applications, affidavits, agreements, and other documents necessary or desirable to secure, renew, amend, or transfer any mining permits, water rights, easement rights, right of eminent domain, timber rights, road right-of-way, and other auxiliary rights necessary for the Exploration, Development, Utilization and Productive Operation of the Contract Area, and (iii) to do all acts necessary or desirable for the Exploration, Development, Utilization and Productive Operation of the Contract Area.

Atlas hereby confirms and ratifies any and all actions and things performed or done by the CCC as the it's attorney-in-fact or any of its representatives hereunder in each case pursuant to the powers granted hereunder.

This special power of attorney shall be deemed coupled with an interest, and cannot be revoked by Atlas until, and shall be automatically revoked upon, the termination of this Agreement.

Section 1.3 Delivery of Mining Documents

Upon execution of this Agreement, Atlas shall deliver to CCC copies of all documents and papers pertaining to the Toledo Mine Rights, including map, geological reports and other mining data, as CCC may reasonably request.

Upon execution of this Agreement, Atlas shall also deliver to CCC copies of all documents and papers pertaining to its right, interest and title to the Fixed Assets and the Surface Rights.

Section 1.4 Atlas' Exploration Rights and Grant of Development Rights to CCC

The Parties agree that Atlas shall have first priority to conduct Exploration activities over the Peripheral Area. However, if Atlas, does not undertake any Exploration activities in a particular area within thirty (30) days after receipt of written notice from CCC of its intention to explore a particular tenement, Atlas shall be deemed to have waived its first priority thereto and CCC may independently proceed with the Exploration of such particular tenement. For the avoidance of doubt; the filing of an application for an Exploration Permit shall be construed as an Exploration activity for the purpose of this provision.

The Parties further agree that the Development, Utilization and Productive Operation rights over the Peripheral Area, if Exploration activities reveal mining resources in such area, shall, subject to terms to be negotiated and mutually agreed between the Parties, pertain to CCC notwithstanding that the Exploration of such particular area has been undertaken by Atlas, and in such case, this Agreement shall be amended to give effect to the inclusion of any such Peripheral Area into the Contract Area.

Atlas further grants unto CCC during the term of this Agreement but not beyond the end of CCC's mining operations non-exclusive access rights to the Peripheral Areas for the sole purpose of exercising its rights under this Agreement.

Section 1.5 Option to Acquire Toledo Mine Rights in Exchange for Shares

CCC shall have the exclusive right and option at any time during the life of this Agreement to acquire all or part of the rights, title and interest of Atlas in the Toledo Mine Rights in exchange for shares in CCC at a valuation determined by an independent third party appraiser accredited by the Securities and Exchange Commission.

Should CCC exercise its option under this Section, it shall give written notice to Atlas and both Parties shall execute a Deed of Assignment in Exchange for Shares within five (5) days from the date of such notice in the form provided in Annex V.

However, CCC's right to retain the Toledo Mine Rights after its exercise of the option under this Section 1.5 shall be subject to reversion under Section 6.5 hereof.

SECTION 2. ACTIVITIES PRIOR TO PRODUCTIVE OPERATION

Section 2.1 Rehabilitation and Improvement of the Fixed Assets

CCC shall perform the following activities in accordance with the highest standards and best mining and business practices:

a. rehabilitate the existing Fixed Assets with a view of resuming Productive Operation of the Contract Area, as envisaged under the Toledo Mining Project;
b. acquire, install and erect the necessary additional infrastructure for the operations of the Toledo Mining Project; and
c. undertake the dewatering of the Contract Area covered by the Toledo Mine Rights to prepare the same for the resumption of mining operations.

Section 2.2 Procurement of Government Permits and Licenses

All government permits and licenses required in connection with the activities pertaining to the Toledo Mining Project shall be obtained by CCC. Atlas undertakes to assist CCC on a best efforts basis to obtain the necessary permits and licenses.

However, government permits and licenses, including without limitation the endorsements and resolutions of the relevant local government units and water rights that relates to the Toledo Mining Project which had already been obtained by Atlas shall, to the extent allowed by such permits, licenses, endorsements, resolutions and

applicable law and regulations, inure to the benefit of, or be transferred or assigned to, CCC. Atlas shall exert best efforts, to the extent allowed by law, in order to have these permits, licenses, endorsements and resolutions or the rights, interests, benefits and privileges thereunder, assigned or transferred to CCC.

Section 2.3 Access to Water Supply from Malubog Dam

Atlas covenants and undertakes to make available to CCC, at cost, such surplus quantity of water as is needed for a production capacity of 42,000 metric tons per day over and above alternative water sources as referred to below. Provided, however, that in the performance of Atlas' obligation to supply water hereunder, it has the sole and exclusive option to tap alternative sources of water suitable for the needs of CCC. Provided, further, that CCC has the first access and priority to the supply of water from the Malubog Dam for the purpose of the Toledo Mining Project in the event no other source of suitable water is available in order for Atlas to comply with its obligations hereunder. CCC's priority over the supply of water from the Malubog Dam shall not be diminished or terminated without its written consent, except when it abandons the Toledo Mining Project, as contemplated in Section 6.5 hereof. In the event, however, that CCC's water requirements for the operation of the Toledo Mine Project exceed such quantity of water, then Atlas or any of its subsidiaries shall provide any such water requirement at a price to be determined by mutual agreement between the parties taking into consideration the prevailing untreated bulk water supply rate.

Atlas shall not transfer its rights and interests in Malubog Dam without the prior written consent of CCC, which consent shall not be unreasonably withheld. In the event that Atlas transfers its rights and interests in Malubog Dam, Atlas undertakes to require as a condition precedent for any such transfer the written agreement of any such transferee to be bound by the obligation of Atlas hereunder with respect to CCC's first access and priority over the water supply from the Malubog Dam.

Section 2.4 Provision of Technical Assistance to CCC

Atlas undertakes to provide CCC technical, administrative and operational assistance, including its technical mining expertise, when and if required by CCC, on terms mutually acceptable to both Parties.

Section 2.5 Expenses Prior to Productive Operation

All expenditures incurred by CCC in performing the activities listed under Section 2, unless otherwise expressly provided, shall pertain solely to CCC's account.

Section 2.6. Period for Resumption of Productive Operation

CCC shall use its best efforts to undertake the activities listed in Section 2.1 above at the soonest possible time in order that Productive Operation shall resume as soon as possible and in accordance with the conditions under its Toledo Mine Rights.

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SECTION 3. FIXED ASSETS, SURFACE RIGHTS AND INVENTORY

Section 3.1 Ownership of the Fixed Assets and the Surface Rights

Subject to the exercise by CCC of its option to purchase under Section 3.2 below, all the Fixed Assets and the Surface Rights made available by Atlas to CCC under the terms of this Agreement shall continue to be owned by Atlas throughout the term of this Agreement. However, all insurance premiums, taxes (including real property taxes), license fees and other charges payable on the aforementioned Fixed Assets and Surface Rights incurred during the term of this Agreement shall be for the account of CCC and shall not be chargeable to Atlas.

Atlas shall not assign, convey or mortgage any of the Fixed Assets, the Surface Rights, and/or its rights or interests therein, without the written consent of CCC. In case any involuntary lien is made on the Fixed Assets and/or the Surface Rights, Atlas shall immediately secure the release of the Fixed Assets and/or the Surface Rights therefrom. Any sale, transfer or alienation made by Atlas over the Fixed Assets and/or the Surface Rights, or any part thereof, without the consent of CCC shall be null and void. To the extent allowed by law, Atlas shall register or annotate this Agreement in the documents of title covering the Fixed Assets and the Surface Rights.

Section 3.2 Option to Purchase the Fixed Assets and the Surface Rights

CCC shall have the exclusive and irrevocable right and option at any time during the life of this Agreement to purchase outright all or part of Atlas' rights, title or interest in any of the Fixed Assets and the Surface Rights by giving Atlas written notice of its intention.

The transfer of the Fixed Assets and the Surface Rights to CCC upon exercise of the option as aforesaid shall be completed upon payment to Atlas the amount equivalent to the valuation of the Fixed Assets and the Surface Rights (the "Option Price") to be determined by an independent third party appraiser accredited by the Securities and Exchange Commission. CCC may deduct the aggregate cost of rehabilitation, maintenance and improvement of the Fixed Assets and the Surface Rights from the Option Price, provided that such rehabilitation and improvement costs are duly supported by official receipts.

However, CCC's right to retain the Fixed Assets and the Surface Rights after its exercise of the option under this Section 3.2 shall be subject to reversion under Section 6.5 hereof.

Section 3.3 Cost of Operating, Maintaining and Repairing the Fixed Assets and the Surface Rights

The costs incurred for operating and maintaining the Fixed Assets and the

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Surface Rights during the period covered by this Agreement shall be borne solely by CCC without any right for reimbursement from Atlas. For the avoidance of doubt, the costs herein contemplated do not include the rehabilitation and improvement costs referred to in Section 2 hereof.

Section 3.4 Ownership and Costs of Inventory

Inventory used by CCC in the operation of the Toledo Mining Project during the term of this Agreement shall belong exclusively to CCC. CCC shall have the right to remove such Inventory from the Project Site upon termination of the Agreement.

It is hereby understood that CCC shall bear all the costs, with no right of recourse to Atlas, associated with the provision of the Inventory.

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SECTION 4. PRODUCTIVE OPERATION

Section 4.1 CCC's Rights and Obligations

CCC, its agents, representatives, and assigns, shall, during the life of this Agreement, undertake the following activities upon resumption of Productive Operation in accordance with the highest standards and best mining and business practices:

a. Perform such additional Development work which CCC shall deem necessary under the Toledo Mining Project;

b. Construct the necessary roadways, mining drainage and all other types of work on the Toledo Mining Project and obtain, with the assistance of Atlas, all the necessary rights of way for this purpose;

c. Develop, utilize, mine, process and market all the minerals and metals found, on or within the Contract Area covered by the Toledo Mine Rights which, in the sole judgment of CCC, can be developed, utilized, mined, processed and marketed at a fair and reasonable profit;

d. Erect, install or place within the Project Site of the Toledo Mining Project such additional mills, plants, buildings, improvements, supplies, machinery and equipment of all kinds and nature necessary for its operations, and to use, sell or otherwise dispose of, change, improve, remove or demolish the same, except for the Fixed Assets;

e. Use any type of milling processes and plants to be able to process any product obtained under the Toledo Mining Project. Provided that any change from the current milling process covered by a Certificate of Non-compliance (CNC) shall be subject to the requirements of the Environmental Impact Statement System (EIS) and compliance with the Environmental Compliance Certificate which shall be secured by CCC in this event;

f. Mine, mill, process and market all products obtained under the Toledo Mining Project, and be entitled to all the revenues and income derived therefrom, without restriction on the part of Atlas;

g. Enter into contracts, agreements, assignments, conveyances and undertakings of any and all kinds with reference to any Exploration, Development, and other operations pertaining to the Toledo Mining Project; provided that the rights and interests of Atlas under this Agreement are preserved and maintained;

h. Employ such staff employees, technicians, and skilled and unskilled laborers as may be needed to carry out CCC's powers, rights, privileges, obligations and commitments under this Agreement, and to

dismiss any such personnel when CCC deems it necessary and desirable.

i. Perform all acts consistent with its rights and privileges under this Agreement provided that Atlas' interests are preserved and maintained.

Section 4.2 Manner of Performance and Compliance with Law

CCC shall promptly perform the activities under this Agreement with reasonable diligence, efficiency and economy. The performance of such activities shall be in accordance with applicable laws, including compliance with the requirements of relevant environmental laws. CCC shall also take appropriate measures to protect and enhance the environment, such as, but not limited to, rehabilitation, revegetation, reforestation and slope stabilization of mined areas.

Section 4.3 Expenses, Fees and Other Charges

a. All expenses for the Exploration, Development, Productive Operation, and Utilization of the Toledo Mining Project shall be for the account of CCC.

b. Expenses for the maintenance and preservation of rights of way, Surface Rights and other rights, permits and licenses pertaining to the actual mining and processing operations shall be chargeable to CCC.

c. All taxes, fees and charges, occupation fees, as well as annual assessment work obligations, whether local or national, due or may be due on the Toledo Mining Project or arising from the exercise of the rights under the Toledo Mine Rights, shall be for the account of CCC.

d. CCC shall submit to Atlas evidence of the payment of the aforementioned items within thirty (30) days from the due date of such payment.

Section 4.4 Atlas' Rights and Obligations

a. Under this Agreement, Atlas shall be entitled to a fee computed in accordance with the formula indicated in the attached Annex VI.

b. Atlas, or its authorized representative, shall have free access at all times to inspect and observe operations within the Project Site covered by the Toledo Mining Project, both above and below the ground; provided that, prior notice is given to CCC and such inspection shall be made during reasonable office hours and in such manner as not to interfere with the normal operations of CCC;

c. Atlas shall provide CCC with all necessary resources to assist CCC in carrying out its undertakings in connection with the Toledo Mining

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Project, subject to Atlas' right to reimbursement of cost, as mutually agreed upon by the Parties; and

d. Upon exercise of CCC's option to purchase under Sections 1.5 and 3.2 above, Atlas, or its subsidiary or successor-in-interest, shall have the right of first refusal on any contract mining civil engineering works of whatever kind and nature in the connection with the operation of the Toledo Mining Project, as long as the proposals submitted by Atlas are competitive within the industry.

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SECTION 5. WARRANTIES AND REPRESENTATIONS

Section 5.1. Warranties on Possession and Ownership

Atlas warrants and represents that it has the exclusive, unrestricted and lawful rights to the occupancy, possession, and beneficial use of the Toledo Mine Rights, the Fixed Assets, Malubog Dam, Water Rights and the Surface Rights. Atlas further represents and warrants that there are no liens, obligations, or encumbrances on the Toledo Mine Rights, the Fixed Assets, Malubog Dam, Water Rights and the Surface Rights, or any adverse claimants or any third party holding or claiming any right thereto, other than those already disclosed to CCC. The Toledo Mine Rights, Surface Rights and Water Rights are in full force and effect and enforceable by the Atlas against the government and/or existing claimowners or landowners.

Section 5.2 Conveyance to Other Parties; Peaceful Occupation by CCC

Atlas warrants and represents that its rights to the Toledo Mine Rights, the Fixed Assets, Malubog Dam, Water Rights and the Surface Rights have not been transferred, assigned or conveyed to third parties. Such rights shall not be transferred, assigned or conveyed in favor of anyone during the effectivity of this Agreement without the prior written consent of CCC. Upon any such transfer or assignment by Atlas, it shall, as a condition for such transfer or assignment, obtain the written agreement of any such transferee or assignee to be bound by the obligations of Atlas hereunder.

Atlas further warrants and represents that it shall keep CCC in peaceful and quiet occupancy, possession and enjoyment of the Toledo Mine Right, the Fixed Assets, Malubog Dam, Water Rights and the Surface Rights; and shall hold CCC free and harmless from all actions, liabilities, demands or claims of any kind affecting its rights to possess, occupy, use and enjoy the Toledo Mine Rights, the Fixed Assets and the Surface Rights.

Section 5.3 Warranty of Maintenance of Title over Properties

CCC covenants and warrants that it shall maintain the rights, interest and/or title of Atlas over the Toledo Mine Rights, the Fixed Assets, the Malubog Dam, the Water Rights and the Surface Rights; and shall keep the same valid and subsisting, subject to the terms of this Agreement.

Section 5.4 Warranty on Taxes

CCC represents and warrants that it shall comply with its obligation to pay all taxes (including real property tax and mineral property occupation fees), fees, assessments and other charges over the use of the Toledo Mine Rights, the Fixed Assets and the Surface Rights in accordance with the provisions of this Agreement.

Section 5.5 Warranty on Authority

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Atlas and CCC mutually warrant and represent that they are duly organized corporations and are validly existing under Philippine law.

Atlas and CCC mutually warrant that they have full legal right, power, and authority to incur the obligations provided for in this Agreement, to execute and deliver this Agreement, and to perform and observe the terms and conditions hereof.

Atlas and CCC further represent and warrant that their representatives possess full power and authority to enter into this Agreement and perform their respective obligations hereunder, and they have taken all appropriate and necessary corporate and legal action to authorize their execution, delivery and performance of this Agreement.

Atlas and CCC further represent and warrant that this Agreement constitutes, or when executed and delivered pursuant hereto will constitute, their legal, valid and binding obligations, enforceable in accordance with its terms.

Atlas and CCC mutually warrants that their execution, delivery and performance of this Agreement do not and will not (i) violate the Constitution or any law, decree, regulation, order or other governmental directive; or (ii) conflict with or result in the breach of any agreement or instrument to which they are a party or by which any of its property is bound.

Atlas represents and warrants that all consents, licenses, governmental approvals and authorizations, and all declarations, filings and registrations necessary for the execution, delivery, performance, validity and enforceability this Agreement shall have been obtained and effected and shall be in full force and effect as of the time required by law.

Section 5.6 Defense of Suits Resulting from a Breach of Warranties and Representations

If suit is brought at anytime during the life of this Agreement against Atlas contesting its rights, title and interests in the Toledo Mine Rights, the Fixed Assets, and the Surface Rights; or against CCC contesting its rights under this Agreement to hold, possess, occupy, use and enjoy the Toledo Mine Rights, the Fixed Assets, and the Surface Rights; Atlas and CCC shall mutually consult with each other and CCC shall promptly retain the services of a competent legal counsel to oppose any such suit.

All expenses incurred in defending any such suit including attorney's fees and any damages adjudged against Atlas and/or CCC shall be the exclusive liability and for the sole account of Atlas unless any such suit has arisen due to acts or omissions directly and solely attributable to CCC or to persons or entities over which CCC exercises control or has authority; provided, however, that if CCC acted in good faith for the benefit of both Parties, such expenses shall still be borne by Atlas.

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Section 5. 7 Warranty on Liabilities

Atlas hereby warrants that none of its obligations shall be passed on to CCC by virtue of this Agreement, unless otherwise expressly provided herein. In the event that CCC shall be held liable for any claims pertaining to Atlas' liabilities, Atlas shall fully indemnify CCC for all the costs incurred by CCC in connection with the said claims.

Except as disclosed in the Disclosure Statement, Atlas represents and warrants that there is no litigation, claim, investigation, proceeding or dispute pending, or to the best of its knowledge, threatened against or affecting it or any Toledo Mine Rights, Fixed Assets, Malubog Dam, Water Rights and the Surface Rights which could reasonably be expected to have an adverse effect on the Exploration, Development, Utilization and Productive Operation of the Toledo Mine.

Except as disclosed in the Disclosure Statement and to the best of its knowledge, Atlas is not liable for any unremedied violation of any environmental laws or regulations relating to the Toledo Mine and, in particular, the terms and conditions of all current permits, licenses and other authorizations, and all current notifications, that are required under such environmental laws, have been obtained and complied with or duly filed.

SECTION 6. SUSPENSION AND TERMINATION AND ABANDONMENT OF OBLIGATIONS

Section 6.1 Termination at the Option of CCC

If CCC, in its sole discretion, decides that the prospective possibilities of the Toledo Mining Project have been exhausted, or that further Exploration, Development, Utilization, exploitation, operation or processing or the continuance thereof will be uneconomical, CCC shall give written notice thereof to Atlas and this Agreement shall be considered terminated thirty (30) days after Atlas' receipt thereof.

Notwithstanding the foregoing, CCC may, at its sole option and convenience, terminate this Agreement anytime, without cause, by giving a written notice to Atlas and this Agreement shall be considered terminated thirty (30) days after Atlas' receipt of the notice.

Section 6.2 Effects of Termination

Upon termination of this Agreement under Section 6.1 above, the Parties shall perform the following obligations:

a. CCC shall have the obligation to forthwith return to Atlas the operation and possession of the Toledo Mine Rights, the Fixed Assets, and the Surface Rights;

b. All machinery, equipment and Inventory bought or introduced by CCC shall remain the exclusive property of the latter and may be removed by CCC within a reasonable time from the termination of this Agreement; and

c. Within three (3) months after the expiration of this Agreement, CCC shall turn over to Atlas all the relevant data, records, documents and other information in its possession relating to the Toledo Mine Rights, the Fixed Assets, and the Surface Rights.

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Section 6.3 Suspension or Termination by Force Majeure

If any Party is rendered unable, wholly, or in part by Force Majeure (as hereafter defined) to carry out its obligations under this Agreement, such obligations, insofar as they are affected by the Force Majeure, shall be suspended until the event of Force Majeure has been eliminated. However, the affected Party undertakes to use due diligence to remove or mitigate the effects of the Force Majeure at the earliest opportunity.

Force Majeure, as herein employed, shall mean any cause, whether foreseeable or unforeseeable, beyond a Party's reasonable control, including, without limitation, the following: strikes and other labor disputes; acts of God; acts of war or conditions arising out of or attributable to war, whether declared or undeclared; riot, epidemic, civil strife, insurrection or rebellion; fire, explosion, earthquake, storm, flood, drought or other adverse weather condition and breakdown of equipment, machinery or facilities having a major effect on the operations, adverse acts of government including delays in the issue of permits and consents, and adverse world and local market conditions in the financial and metals industries.

Upon the occurrence of Force Majeure, the Party affected shall immediately inform the other Party of such occurrence and both Parties shall exert best efforts to mitigate the effects of Force Majeure.

Section 6.4 Effects of Force Majeure

If the effects of Force Majeure continues for a prolonged period of 180 days, notwithstanding the mitigating efforts undertaken by the Parties, CCC may terminate this Agreement by giving a thirty (30)-day prior written notice to the other Party; whereupon, Section 6.2 shall govern the effects of such termination.

Section 6.5 Abandonment of Obligations

In the event CCC abandons the Toledo Mining Project pursuant to a unanimous decision to do so by its shareholders to cease with definitiveness the productive operations of the Toledo Mining Project, then after a period of 120 days from such abandonment, all rights and interests in the Toledo Mine Rights, the Fixed Assets and the Surface Rights shall automatically revert to Atlas, notwithstanding CCC's exercise of its option to purchase under Section 1.5 or 3.2 above, unless the abandonment is caused by Force Majeure or reasons attributable to Atlas. In the event of such reversion, CCC shall execute the necessary documents to convey title to the said assets upon the return by Atlas of the Option Price under Section 3.2 or the original value of the CCC shares issued in exchange therefor pursuant to Section 1.5.

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SECTION 7. SETTLEMENT OF DISPUTES

Section 7.1 Amicable Settlement and Arbitration

Should there be a claim, demand, dispute, or controversy concerning or involving any provision of this Agreement, the Parties shall exert all efforts to settle it amicably. If settlement is not reached by them, the claim, demand, dispute or controversy shall be referred to a Board of Arbitrator's composed of three (3) members, one appointed or selected by each Party, and a third member by the two (2) arbitrators thus chosen.

Section 7.2 Proceedings; Effect of Decision

The Party seeking arbitration shall give written notice to the other Party, of its decision to submit an issue to arbitration and simultaneously identify its selected arbitrator. Within fifteen (15) days from receipt of such notice, the other Party shall by written notice to the Party seeking arbitration, appoints its own arbitrator.

Upon completion of the Board of Arbitrators, the proceedings shall commence within fifteen (15) days and a decision shall be rendered by the Board within thirty (30) days after the parties have completed presenting their respective cases to the Board.

The decision of the majority of the Board shall be final and binding upon the parties and shall be enforceable by action by either Party. No action in court as to any matter aforestated shall be instituted by either Party against each other, except to enforce the award of the Board of Arbitrators, which shall be final for both Parties.

Section 7.3 Sharing of Arbitration Expenses

All expenses in connection with the arbitration proceeding including the fees of the arbitrators shall be equally borne by Atlas and CCC.

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SECTION 8. MISCELLANEOUS PROVISIONS

Section 8.1 Effectivity

This Agreement shall take effect on the date of the execution hereof and shall continue until its termination under the provisions hereof.

Section 8.2. Notices

All letters, notices, statements and other communications which either Party desires or is obliged to furnish the other under this Agreement shall be sent by facsimile, electronic mail, ordinary mail, courier or by personal delivery using the following contact details:

Atlas:	CCC:
Authorized Representative:	Authorized Representative:
Tel Nos.	Tel Nos.
Fax Nos.	Fax Nos.
Email:	Email:
Office Address:	Office Address:

Any changes in the contact details of a Party shall be immediately notified to the other Party.

Section 8.3. Assignment

Either Party may assign its rights and obligations under this Agreement provided that prior written consent of the other Party is obtained, which consent shall not be unreasonably withheld.

Upon any such assignment by Atlas, it shall, as a condition for such assignment, obtain the written agreement of any such assignee to be bound by the obligations of Atlas hereunder.

Section 8.4 . Parties Agreement to Security for Lenders

The Parties reiterate their full and prompt cooperation with each other in obtaining financing for the Toledo Mining Project and shall agree on reasonable arrangements with the lenders to ensure such successful financing.

Section 8.5 Waiver

The non-exercise of or delay in the exercise of any power or right of a Party does not operate as a waiver of that power or right, nor does any single exercise of a power or right preclude any other exercise of such right or the exercise of any other

power or right. A power or right may only be waived in writing, signed by the Party to be bound by the waiver.

Section 8.6 Cumulative Rights

The rights and remedies provided in this Agreement are cumulative and do not exclude any rights or remedies provided by law.

Section 8.7 Severability

Any provision in this Agreement that is invalid or unenforceable in any jurisdiction shall, as to that jurisdiction, be ineffective only to the extent of the invalidity or unenforceability, without affecting the remaining provisions of this Agreement or affecting the validity or enforceability of that provision in any other jurisdiction.

Section 8.8 Entire Agreement

This Agreement is the complete and exclusive statement of the agreement between the Parties and supersedes all other proposals, statements, conduct, representations, prior agreements and heads of agreement, whether oral, written or implied, between the Parties in relation to this Agreement.

Section 8.9 Cost, Expenses and Taxes

All costs, expenses, and taxes arising from the execution of this Agreement shall be for the account of CCC.

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IN WITNESS WHEREOF, the Parties hereto have signed this Agreement on the date first above written.

ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION	**CARMEN COPPER CORPORATION**
By:	By:
Mr. Martin C. Buckingham Executive Vice President and Director	**Mr. Alfredo C. Ramos** President and Chairman

SIGNED IN THE PRESENCE OF:

FLORIAN RAMOS

Carol Lum

It is hereby certified that this document was duly recorded in the Registration Book under Act 3344.
Inscription No. 11-1358 ; Page 37
Vol. 2 File No. [illegible]
Toledo City [illegible]

RIZALINA RAFOLS-DULFO
OIC-REGISTER OF DEEDS
TOLEDO CITY

ANNEX 2: Copies of MPSAs

2005 JUN 16 AM10 30

MINERAL PRODUCTION SHARING AGREEMENT

No. 210-2005-VII

This **MINERAL PRODUCTION SHARING AGREEMENT** is made and entered into in Quezon City, Philippines, this _____ day of APR 28 2005 by and between:

THE REPUBLIC OF THE PHILIPPINES, herein referred to as the **GOVERNMENT**, represented in this act by the Secretary of the Department of Environment and Natural Resources, with offices at the Department of Environment and Natural Resources Building, Visayas Avenue, Diliman, Quezon City

and

ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION, HEIRS OF JOSE P. VELEZ, HEIRS OF MANUEL CUENCO, ANTONIO V. CUENCO AND JON RAMON ABOITIZ, hereinafter collectively referred to as the **CONTRACTOR**, represented herein by **ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION**, a corporation duly organized and existing under the laws of the Republic of the Philippines, with office at the 6TH Floor, Quad Alpha Centrum, 125 Pioneer Street, Mandaluyong City and represented in this act by its President, **ALFREDO C. RAMOS**, as authorized by its Board of Directors (please refer to ANNEX "A")

WITNESSETH :

WHEREAS, the 1987 Constitution of the Republic of the Philippines provides in Article XII, Section 2 thereof that all lands of the public domain, waters, minerals, coal, petroleum and other natural resources are owned by the State and that their exploration, development and utilization shall be under the full control and supervision of the State;

WHEREAS, the Constitution further provides that the State may directly undertake such activities, or it may enter into a Co-Production, Joint Venture, or Mineral Production Sharing Agreement with Filipino citizens, or cooperatives, partnerships, corporations or associations at least sixty per centum of whose capitalization is owned by such citizens;

WHEREAS, pursuant to Republic Act No. 7942, otherwise known as "The Philippine Mining Act of 1995," which took effect on 09 April 1995, the Secretary of the Department of Environment and Natural Resources is authorized to enter into Mineral Production Sharing Agreements in furtherance of the objectives of the Government and the Constitution to bolster the national economy through sustainable and systematic development and utilization of mineral lands;

WHEREAS, Atlas Consolidated Mining and Development Corporation (ACMDC), Heirs of Jose P. Velez, Heirs of Manuel Cuenco, Antonio V. Cuenco and Jon Ramon Aboitiz are the lessees of Mining/Lode Lease Contracts issued under previous laws;

WHEREAS, ACMDC is the representative of the other lessees mentioned above in filing and securing approval of mining applications over the leased areas;

WHEREAS, on June 19, 1998, ACMDC filed an application for Mineral Production Sharing Agreement for itself and as representative of the same lessees above covering the areas subject of the Mining/Lode Lease Contracts, in the Mines and Geosciences Bureau Regional Office No. VII;

WHEREAS, the Contractor has access to all the financing, technical competence, technology and environmental management skills required to promptly and effectively carry out the objectives of this Agreement;

NOW, THEREFORE, for and in consideration of the foregoing premises, the mutual covenants, terms and conditions hereinafter set forth, it is hereby stipulated and agreed as follows:

SECTION I

SCOPE

1.1. This Agreement is a Mineral Production Sharing Agreement entered into pursuant to the provisions of the Act and its implementing rules and regulations. The primary purpose of this Agreement is to provide for the sustainable development and commercial utilization of copper, gold and other associated mineral deposits existing within the Contract Area, with all necessary services, technology and financing to be furnished or arranged by the Contractor in accordance with the provisions of this Agreement. The Contractor shall not, by virtue of this Agreement, acquire any title over the Contract/Mining Area without prejudice to the acquisition by the Contractor of the land/surface rights through any mode of acquisition provided for by law.

1.2. The Contractor shall undertake and execute, for and on behalf of the Government, sustainable mining operations in accordance with the provisions of this Agreement, and is hereby constituted and appointed, for the purpose of this Agreement, as the exclusive entity to conduct mining operations in the Contract Area. Provided, That any working agreement entered into by and between ACMDC and the Heirs of Jose P. Velez, Heirs of Manuel Cuenco, Antonio V. Cuenco and Jon Ramon Aboitiz involving the Contract Area, which terms and conditions are contrary hereto, shall be their exclusive and sole responsibility.

1.3. During the term of this Agreement, the total value of production and sale of minerals derived from the mining operations contemplated herein shall be accounted for and divided between the Government and the Contractor in accordance with Section VI hereof.

SECTION II

DEFINITIONS

As used in this Agreement, the following words and terms, whether singular or plural, shall have the following respective meaning:

2.1. Act refers to Republic Act No. 7942, otherwise known as the "Philippine Mining Act of 1995."

2.2. Agreement means this Mineral Production Sharing Agreement.

2.3. Associated Minerals mean other ores/minerals, which occur together with the principal ore/mineral.

2.4. Bangko Sentral means Bangko Sentral ng Pilipinas.

2.5. Budget means an estimate of expenditures to be made by Contractor in mining operations contemplated hereunder to accomplish the Work Program for each particular period.

2.6. Bureau means Mines and Geosciences Bureau.

2.7. Calendar Year or Year means a period of twelve (12) consecutive months starting with the first day of January and ending on December 31, while "Calendar Quarter" means a period of three consecutive months with the first calendar quarter starting with the first day of January.

2.8. Commercial Production means the production of sufficient quantity of minerals to sustain economic viability of mining operations reckoned from the date of commercial operation as declared by the Contractor or as stated in the feasibility study, whichever comes first.

2.9. Constitution or Philippine Constitution means the 1987 Constitution of the Republic of the Philippines adopted by the Constitutional Convention of 1986 on October 15, 1986 and ratified by the People of the Republic of the Philippines on February 2, 1987.

2.10. Contract Area means the area onshore or offshore delineated under the Mineral Production Sharing Agreement subject to the relinquishment obligations of the Contractor and properly defined by latitude and longitude or bearing and distance.

2.11. Contract Year means a period of twelve (12) consecutive months counted from the Effective Date of this Agreement or from the anniversary of s uch Effective Date.

2.12. Contractor means Atlas Consolidated Mining and Development Corporation, Heirs of Manuel Cuenco, Heirs of Jose P. Velez, Manuel V. Cuenco and Jon Ramon Aboitiz or their respective assignees or assignees of interest under this Agreement: Provided, That the assignment of any of such interest is accomplished pursuant to the pertinent provisions of the implementing rules and regulations of the Act.

2.13. Declaration of Mining Feasibility means a document proclaiming the presence of minerals in a specific site, which are recoverable by socially acceptable, environmentally safe and economically sound methods specified in the Mine Development Plan.

2.14. Department or DENR means the Department of Environment and Natural Resources.

2.15. Director means the Director of Mines and Geosciences Bureau.

2.16. Effective Date means the date of execution of this Agreement by the Contractor and by the Secretary on behalf of the Government.

2.17. Environment means all facets of man's surroundings: physical, ecological, aesthetic, cultural, economic, historic, institutional and social.

2.18. Exploration means searching or prospecting for mineral resources by geological, geophysical and geochemical surveys, remote sensing, test pitting, trenching, drilling, shaft sinking, tunneling or any other means for the purpose of determining the existence, extent, quality and quantity of mineral resources and the feasibility of mining them for profit.

2.19. Force Majeure means acts or circumstances beyond the reasonable control of the Contractor including, but not limited to war, rebellion, insurrection, riots, civil disturbances, blockade, sabotage, embargo, strike, lockout, any dispute with surface owners and other labor disputes, epidemics, earthquake, storm, flood or other adverse weather conditions, explosion, fire, adverse action by the Government or by any of its instrumentality or subdivision thereof, act of God or any public enemy and any cause as herein described over which the affected party has no reasonable control.

2.20. Foreign Exchange means any currency other than the currency of the Republic of the Philippines acceptable to the Government and the Contractor.

2.21. Government means the Government of the Republic of the Philippines or any of its agencies and instrumentalities.

2.22. Gross Output means the actual market value of the minerals or mineral products from each mine or mineral land operated as a separate entity, without any deduction for mining, processing, refining, transporting, handling, marketing or any other expenses: Provided, That if the minerals or mineral products are sold or consigned abroad by the Contractor under C.I.F. terms, the actual cost of ocean freight and insurance shall be deducted: Provided further, That in the case of mineral concentrates which are not traded in commodity exchanges in the Philippines or abroad such as copper concentrate, the actual market value shall be the world price quotation of the refined mineral products contained thereof prevailing in the said commodity exchanges, after deducting the smelting, refining, treatment, insurance, transportation and other charges incurred in the process of converting mineral concentrates into refined metal traded in those commodity exchanges.

2.23. Mine Development refers to work undertaken to prepare an ore body or a mineral deposit for mining, including the construction of necessary infrastructure and related facilities.

2.24. Minerals mean all naturally occurring inorganic substances in solid, liquid, gas or any intermediate state excluding energy materials such as coal, petroleum, natural gas, radioactive materials and geothermal energy.

2.25. Mineral Products mean materials derived from mineral ores/rocks and prepared into marketable state by metallurgical processes which include beneficiation, cyanidation, leaching, smelting, calcination and other similar processes.

2.26. Mining Area means that portion of the Contract Area identified by the Contractor as defined and delineated in a Survey Plan duly approved by the Director/Regional Director concerned for purposes of development and/or utilization and sites for support facilities.

2.27. Mining Operations means mining activities involving exploration, feasibility study, environmental impact assessment, development, utilization, mineral processing and mine rehabilitation.

2.28. Notice means notice in writing, telex or telecopy (authenticated by answer back or confirmation received) addressed or sent as provided in Section 13.2 of this Agreement.

2.29. Ore means naturally occurring substance or material from which a mineral or element can be mined and/or processed for profit.

2.30. Pollution means any alteration of the physical, chemical and/or biological properties of any water, air and/or land resources of the Philippines, or any discharge thereto of any liquid, gaseous or solid wastes or any production of unnecessary noise or any emission of objectionable odor, as will or is likely to create or render such water, air, and land resources harmful, detrimental or injurious to public health, safety or welfare or which will adversely affect their utilization for domestic, commercial, industrial, agricultural, recreational or other legitimate purposes.

2.31. Secretary means the Secretary of the Department of Environment and Natural Resources.

2.32. State means the Republic of the Philippines.

2.33. Work Program means a document which presents the plan of major mining operations and the corresponding expenditures of the Contractor in its Contract Area during a given period of time, including the plan and expenditures for development of host and neighboring communities and of local geoscience and mining technology, as submitted and approved in accordance with the implementing rules and regulations of the Act.

SECTION III

TERM OF AGREEMENT

3.1. This Agreement shall have a term of twenty five (25) years from Effective Date, and may be renewed thereafter for another term not exceeding twenty five (25) years. The renewal of this Agreement, as well as the changes in the terms and conditions thereof, shall be upon mutual consent by the parties. In the event the Government decides to allow mining operations thereafter by other Contractor, this must be through competitive public bidding. After due

publication of notice, the Contractor shall have the right to equal the highest bid upon reimbursement of all reasonable expenses of the highest bidder.

SECTION IV

CONTRACT AREA

4.1. Size, Shape, and Location of Contract Area - This Agreement covers a Contract Area of approximately Two Hundred Thirty Four and 2875/10000 (234.2875) hectares, situated in Toledo City, Cebu and bounded by the following technical description (please refer to ANNEX "B" – 1:50,000 scale Location Map/Sketch Plan):

Corner	Latitude	Longitude
1	10° 19' 29.936"	123° 42' 51.065"
2	10° 19' 39.105"	123° 42' 54.458"
3	10° 19' 35.744"	123° 43' 03.716"
4	10° 19' 58.471"	123° 43' 12.128"
5	10° 19' 58.463"	123° 43' 15.763"
6	10° 20' 17.991"	123° 43' 15.808"
7	10° 20' 17.964"	123° 43' 28.111"
8	10° 20' 47.887"	123° 43' 27.150"
9	10° 20' 48.817"	123° 43' 56.718"
10	10° 20' 19.539"	123° 43' 57.656"
11	10° 20' 15.938"	123° 43' 51.853"
12	10° 20' 13.010"	123° 43' 51.946"
13	10° 20' 12.885"	123° 43' 48.004"
14	10° 20' 09.469"	123° 43' 48.114"
15	10° 20' 09.365"	123° 43' 44.828"
16	10° 20' 08.160"	123° 43' 45.366"
17	10° 19' 48.361"	123° 43' 45.321"
18	10° 19' 48.653"	123° 43' 35.461"
19	10° 19' 29.125"	123° 43' 35.416"
20	10° 19' 29.131"	123° 43' 32.773"
21	10° 19' 25.663"	123° 43' 31.490"
22	10° 19' 29.023"	123° 43' 22.232"
23	10° 19' 19.885"	123° 43' 18.839"
24	10° 19' 23.215"	123° 43' 09.581"
25	10° 19' 32.384"	123° 43' 12.974"
26	10° 19' 29.023"	123° 43' 22.232"
27	10° 19' 38.191"	123° 43' 25.626"
28	10° 19' 41.551"	123° 43' 16.368"
29	10° 19' 32.383"	123° 43' 12.974"
30	10° 19' 35.744"	123° 43' 03.716"
31	10° 19' 26.575"	123° 43' 00.323"

4.2. Survey Plan of the Contract Area - The Contractor shall submit for approval by the Regional Director concerned, a survey plan for the Contract Area within sixty (60) days from the effectivity of this Agreement.

SECTION V

OPERATING PERIOD

5.1 Timetable - The Contractor may commence commercial utilization activity immediately upon approval and registration of this Agreement, subject to the provision of Section 7.3 hereof. The Contractor shall conduct mining

operations and other activities for the duration of the Operating Period in accordance with the duly approved Work Program and Budget and Environmental Compliance Certificate/Certificate of Non-coverage (please refer to ANNEXES "C" and "D"). Failure by the Contractor to undertake commercial utilization within the period in accordance with the said Work Program shall be considered a substantial breach of the Agreement.

5.2 Commercial Operation Work Program and Budget - During the Operating Period, the Contractor shall submit to the Director, through the Regional Director concerned, Work Programs and Budgets covering a period of three (3) years each, which shall be submitted not later than thirty (30) days before the expiration of the period covered by the previous Work Program.

The amount to be spent by the Contractor during the Operating Period under the term of this Agreement shall not be less than that specified in the approved Work Programs, such that during the first three (3) years of the Operating Period, this amount shall be as follows:

First Contract Year	(Rehabilitation)
Second Contact Year	PhP 1,872,571,000.00
Third Contract Year	PhP 3,816,917,000.00

Should the Government wish to propose a revision to a certain specific feature in the Work Program or Budget, it shall, within thirty (30) days after receipt thereof, provide a Notice to the Contractor specifying in reasonable detail its reasons therefore. Promptly thereafter, the Government and Contractor will meet and endeavor to agree on the revision proposed by the Government. In any event, any portion of said Work Program or Budget as to which the Government shall fail to notify the Contractor of proposed revision shall, in so far as possible, be carried out as prescribed herein. If the Government should fail within sixty (60) days from receipt thereof to notify Contractor of the proposed revisions, the Work Program and Budget proposed by the Contractor shall be deemed to be approved.

It is recognized by the Government and the Contractor that the details of any Work Program may require changes in the light of changing circumstances. The Contractor may make such changes: Provided, That it shall not change the general objective of the Work Program: Provided further, That changes which entail a variance of at least twenty percent (20%) shall be subject to the approval of the Director.

The Government's approval of a proposed Work Program and Budget will not be unreasonably withheld.

5.3 Expansion and Modification of Facilities - The Contractor may make expansions, modifications, improvements, and replacements of the mining facilities and may add new facilities as the Contractor may consider necessary for the operations: Provided, That such plans shall be embodied in an appropriate Work Program approved by the Director.

5.4 Reporting

a. Quarterly Reports - Beginning with the first Calendar Quarter following the approval of this Agreement, the Contractor shall submit, within thirty (30) days after the end of each Calendar Quarter, to the Director, through the Regional Director concerned, a Quarterly Report stating the tonnage of production in terms of ores, concentrates, and their corresponding grades and other types of products; value, destination of sales or exports and to whom sold; terms of sales and expenditures.

b. Annual Reports - During the Operating Period, the Contractor shall submit, within sixty (60) days from the end of each Calendar Year, to the Director through the Regional Director concerned, an Annual Report indicating in sufficient detail:

b.1. The total tonnage of ore reserves whether proven, probable, or inferred, the total tonnage of ores, kind by kind, broken down between tonnage mined, tonnages transported from the minesite and their corresponding destination, tonnages stockpiled in the mine and elsewhere in the Philippines, tonnages sold or committed for export (whether actually shipped from the Philippines or not), tonnages actually shipped from the Philippines (with full details as to purchaser, destination and terms of sale), and if known to the Contractor, tonnages refined, processed or manufactured in the Philippines with full specifications as to the intermediate products, by-products or final products and of the terms at which they were disposed;

b.2. Work accomplished and work in progress at the end of the year under consideration in relation to the Work Program, including the investment actually made or committed; and

b.3. Profile of work force, including management and staff, stating particularly their nationalities, and for Filipinos, their place of origin (i.e., barangay, town, province, region).

The Contractor shall also comply with other reporting requirements as provided in the implementing rules and regulations of the Act.

SECTION VI

FISCAL REGIME

6.1. General Principle - The fiscal regime of this Agreement shall be governed by the principle according to which the Government expects a reasonable return in economic value for the utilization of non-renewable mineral resources under its national sovereignty while the Contractor expects a reasonable return on its investment with special account to be taken for the high risk of exploration, the terms and conditions prevailing elsewhere in the industry and any special efficiency to be gained by a particularly good performance of the Contractor.

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6.2. Registration Fees - Within fifteen (15) days upon receipt of the notice of approval of the Agreement from the Regional Office concerned, the Contractor shall cause the registration of this Agreement with the said Regional Office and pay the registration fee at the rate provided in the existing rules and regulations. Failure of the Contractor to cause the registration of this Agreement within the prescribed period shall be sufficient ground for cancellation of the same.

6.3. Occupation Fees - Prior to registration of this Agreement and at the same date every year thereafter, the Contractor shall pay to the Municipal/City Treasurer concerned an occupation fee over the Contract Area at the annual rate provided in the existing rules and regulations. If the fee is not paid on the date specified, the Contractor shall pay a surcharge of twenty five percent (25%) of the amount due in addition to the occupation fees.

6.4. Share of the Government - The Government Share shall be the excise tax on mineral products at the time of removal and at the rate provided for in Republic Act No. 7729 amending Section 151 (a) of the National Internal Revenue Code, as amended, as well as other taxes, duties and fees levied by existing laws. The Excise Tax shall be timely and completely paid to the nearest Bureau of Internal Revenue Office in the province concerned.

For purposes of determining the amount of the herein Government Share, the Contractor shall strictly comply with the auditing and accounting requirements prescribed under existing laws and regulations.

The Government Share shall be allocated in accordance with Sections 290 and 292 of Republic Act No. 7160, otherwise known as "The Local Government Code of 1991."

6.5. Pricing of Sales - The Contractor shall dispose of the minerals and by-products produced at the highest market price prevailing in the locality: The Contractor shall also pay the lowest achievable marketing commissions and related fees and shall negotiate for more advantageous terms and conditions subject to the right to enter into long-term sales or marketing contracts or foreign exchange and commodity hedging contracts, which the Government acknowledges to be acceptable notwithstanding that the sale price of the minerals and by-products may from time to time be lower, or the terms and conditions of sales are less favorable, than that available elsewhere. The Contractor shall seek to strike a balance between long-term sales or marketing contracts or foreign exchange and commodity hedging contracts comparable to policies followed by independent producers in the international mining industry.

The Contractor shall likewise seek a balanced distribution among consumers. Insofar as sales to Contractor's affiliate(s) are concerned, prices shall be at arm's length standard, and competing offers for large scale and long-term contracts shall be procured. Before any sale and/or shipment of mineral product is made, existing and future marketing contract(s)/sales agreement(s) shall be submitted to the Director, copy furnished the Regional Director concerned, for registration. At the same time, the Contractor shall regularly inform the Director in writing of any revisions, changes or additions in said contract(s)/agreement(s).

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The Contractor shall reflect in its Monthly/Quarterly Report on Production, Sales and Inventory of Minerals, as well as in the Integrated Annual Report, the corresponding registration number(s) of the marketing contract(s)/ agreement(s) governing the export or sale of minerals.

6.6. Associated Minerals - If minerals other than copper and gold are discovered in commercial quantities in the Contract Area, the value thereof shall be added to the value of the principal mineral in computing the Government share.

SECTION VII

ENVIRONMENTAL PROTECTION AND MINE SAFETY AND HEALTH

7.1. The Contractor shall manage its Mining Operations in a technically, financially, socially, culturally and environmentally responsible manner to achieve the sustainable development objectives and responsibilities as provided for under the implementing rules and regulations of the Act.

7.2. The Contractor shall ensure that the standards of environmental protection are met in the course of the Mining Operations. To the extent possible, control of pollution and the transformation of the mined-out areas or materials into economically and socially productive forms must be done simultaneously with mining.

7.3. An Environmental Compliance Certificate (ECC) shall be secured first by the Contractor prior to the conduct of any development works, construction of production facilities and/or mine production activities, including the commissioning of any new tailings disposal site in or outside the Contract Area.

7.4. The Contractor shall submit within thirty (30) Calendar days after the issuance and receipt of the ECC, an Environmental Protection and Enhancement Program (EPEP) using MGB Form No. 16-2 covering all areas to be affected by development, utilization and processing activities under this Agreement. The Contractor shall allocate for its initial environment-related capital expenditures approximately ten percent (10%) of the total project cost or in such amount depending on the environmental/geological condition, nature and scale of operations and technology to be employed in the Contract Area.

7.5. The Contractor shall submit, within thirty (30) days prior to the beginning of every calendar year, an Annual Environmental Protection and Enhancement Program (AEPEP), using MGB Form 16-3, which shall be based on the approved EPEP. The AEPEP shall be implemented during the year for which it was submitted. To implement its AEPEP, the Contractor shall allocate annually three to five percent (3%-5%) of its direct mining and milling costs depending on the environmental/geologic condition, nature and scale of operations and technology employed in the Contract Area.

7.6. The Contractor shall establish a Contingent Liability and Rehabilitation Fund (CLRF) which shall be in the form of the Mine Rehabilitation Fund (MRF) and the Mine Waste and Tailings Fee (MWTF).

The MRF shall be based on the financial requirements of the approved EPEP as a reasonable environmental deposit to ensure satisfactory compliance with the commitments/strategies of the EPEP/AEPEP and availability of funds for the performance of the EPEP/AEPEP during the specific project phase. The MRF shall be deposited as Trust Fund in a government depository bank and shall be used for physical and social rehabilitation of areas affected by mining activities and for research on the social, technical and preventive aspects of rehabilitation.

The MWTF shall be collected based on the amounts of mine waste and mill tailings generated during the conduct of Mining Operations. The MWTF collected shall accrue to a Mine Waste and Tailings Reserve Fund and shall be deposited in a government depository bank for payment of compensation for damages caused by the Mining Operations.

7.7. The Contractor shall set up mitigating measures such as mine waste and mill tailings disposal system, mine rehabilitation or plan, water quality monitoring, etc. to minimize land degradation, air and water pollution, acid rock drainage and changes in hydrogeology.

7.8. The Contractor shall set up an Environmental and Safety Office at its minesite manned by qualified personnel to plan, implement and monitor its approved EPEP.

7.9. The Contractor shall be responsible in the monitoring of environmental, safety and health conditions in the Contract Area and shall strictly comply with all the rules and regulations embodied under DAO No. 2000-98, otherwise known as the "Mine Safety and Health Standards."

7.10. The Contractor shall be responsible for the submission of a final mine rehabilitation and/or decommissioning plans, including its financial requirements and incorporating the details and particulars set forth in the implementing rules and regulations of the Act.

SECTION VIII

RIGHTS AND OBLIGATIONS OF THE PARTIES

8.1. Obligations of the Contractor:

a. To exclusively conduct sustainable Mining Operations within the Contract Area in accordance with the provisions of the Act and its implementing rules and regulations;

b. To construct and operate any facilities specified under the Mineral Agreement or approved Work Program;

c. To determine the exploration, mining and treatment process to be utilized in the Mining Operations;

d. To extract, remove, use and dispose of any tailings as authorized by an approved Work Program;

e. To secure all permits necessary or desirable for the purpose of Mining Operations;

f. To keep accurate technical records about the Mining Operations, as well as financial and marketing accounts, and make them available to Government representatives authorized by the Director for the purpose of assessing the performance and compliance of the Contractor with the terms of this Agreement. Authorized representatives of other Government Agencies may also have access to such accounts in accordance with existing laws, rules and regulations;

g. To furnish the Bureau all the data and information gathered from the Contract Area and that all the books of accounts and records shall be open for inspection;

h. To allow access to Government during reasonable hours in inspecting the Contract Area and examining pertinent records for purposes of monitoring compliance with the terms of this Agreement;

i. To hold the Government free and harmless from all claims and accounts of all kinds, as well as demands and actions arising out of the accidents or injuries to persons or properties caused by Mining Operations of the Contractor and indemnify the Government for any expenses or costs incurred by the Government by reason of any such claims, accounts, demands or actions;

j. In the development of the community:

j.1. To recognize and respect the rights, customs and traditions of indigenous cultural communities over their ancestral lands and to allocate royalty payment of not less than one percent (1%) of the value of the gross output of minerals sold;

j.2. To coordinate with proper authorities in the development of the mining community and for those living in the host and neighboring communities through social infrastructure, livelihood programs, education, water, electricity and medical services. Where traditional self-sustaining income and the community activities are identified to be present, the Contractor shall assist in the preservation and/or enhancement of such activities;

j.3. To allot annually a minimum of one percent (1%) of the direct mining and milling costs necessary to implement the activities undertaken in the development of the host and neighboring communities. Expenses for community development may be charged against the royalty payment of at least one percent (1%) of the gross output intended for the concerned indigenous cultural community;

j.4. To give preference to Filipino citizens who have established domicile in the neighboring communities, in the hiring of personnel for its mining operations. If necessary skills and

expertise are currently not available, the Contractor must immediately prepare and undertake a training and recruitment program at its expense; and

j.5. To incorporate in the Mining Feasibility Study the planned expenditures necessary to implement (j.1) to (j.3) of this Section;

k. In the development of Mining Technology and Geosciences:

k.1. In the course of its operations, to produce geological, geophysical, geochemical and other types of maps and reports that are appropriate in scale and in format and substance which are consistent with the internationally accepted standards and practices. Such maps shall be made available to the scientific community in the most convenient and cost effective forms, subject to the condition that the Contractor may delay release of said information for a reasonable period of time which shall not exceed three (3) years;

k.2. To systematically keep the data generated from the Contract/ Mining Area such as cores, assays and other related information, including economic and financial data and make them accessible to students, researchers and other persons responsible for developing mining, geoscience and processing technology subject to the condition that the Contractor may delay release of data to the science and technology community within a reasonable period of time which shall not exceed three (3) years;

k.3. To transfer to the Government or local mining company the appropriate technology it may adapt in the exploration, development and commercial utilization of the minerals in the Contract Area;

k.4. To allocate research and development budget for the advancement of mining technology and geosciences in coordination with the Bureau, research institutions, academe, etc.; and

k.5. To replicate data, maps and reports cited in (k.1) and (k.2) and furnish the Bureau for archiving and systematic safekeeping which shall be made available to the science and technology community for conducting research and undertaking other activities which contribute to the development of mining, geoscience and processing technology and the corresponding national pool of manpower talents: Provided, however, that the release of data, maps and the like shall be similarly constrained in accordance with (k.1) and (k.2) above;

l. To incorporate in the Mining Feasibility Study the planned expenditures necessary to implement all the plans and programs set forth in this Agreement; and

m. To pay all other taxes and fees mandated by existing laws, rules and regulations.

8.2. Rights of the Contractor:

a. To conduct Mining Operations within the confines of its Contract/Mining Area in accordance with the terms and conditions hereof and without interfering with the rights of other Contractors/Lessees/Operators/ Permittees/Permit Holders;

b. Of possession of the Contract Area, with full right of ingress and egress and the right to occupy the same, subject to surface and easement rights;

c. To use and have access to all declassified geological, geophysical, drilling, production and other data relevant to the mining operations;

d. To sell, assign, transfer, convey or otherwise dispose of all its rights, interests and obligations under the Agreement subject to the approval of the Government;

e. To employ or bring into the Philippines foreign technical and specialized personnel, including the immediate members of their families as may be required in the operations of the Contractor, subject to applicable laws and regulations: Provided, That if the employment connection of such foreign persons with the Contractor ceases, the applicable laws and regulations on immigration shall apply to them. Every time foreign technologies are utilized and where alien executives are employed, an effective program of training understudies shall be undertaken. The alien employment shall be limited to technologies requiring highly specialized training and experience subject to the required approval under existing laws, rules and regulations;

f. To enjoy easement rights and use of timber, water and other natural resources in the Contract Area subject to pertinent laws, rules and regulations and the rights of third parties;

g. Of repatriation of capital and remittance of profits, dividends and interest on loans, subject to existing laws and Bangko Sentral ng Pilipinas rules and regulations; and

h. To import when necessary all equipment, spare parts and raw materials required in the operations in accordance with existing laws and regulations.

8.3. Obligations of the Government:

a. To ensure that the Contractor has the Government's full cooperation in the exercise of the rights granted to it under this Agreement;

b. To use its best efforts to ensure the timely issuance of necessary permits and similar authorizing documents for use of the surface of the Contract Area; and

c. To cooperate with the Contractor in its efforts to obtain financing contemplated herein from banks or other financial institutions: Provided, That such financing arrangements will in no event reduce the Contractor's obligation on Government rights hereunder.

SECTION IX

ASSETS AND EQUIPMENT

9.1. The Contractor shall acquire for the Mining Operations only such assets that are reasonably estimated to be required in carrying out such Mining Operations.

9.2. All materials, equipment, plant and other installations of a movable nature erected or placed on the Contract Area by the Contractor shall remain the property of the Contractor. The Contractor shall have the right to remove and re-export such materials and equipment, plant and other installations from the Philippines, subject to existing rules and regulations. In case of cessation of Mining Operations on public lands occasioned by its voluntary abandonment or withdrawal, the Contractor shall have a period of one (1) year from the time of cessation within which to remove its improvements; otherwise, all social infrastructures and facilities shall be turned over or donated tax free to the proper government authorities, national or local, to ensure that said infrastructures and facilities are continuously maintained and utilized by the host and neighboring communities.

SECTION X

EMPLOYMENT AND TRAINING OF PHILIPPINE PERSONNEL

10.1. The Contractor agrees to employ, to the extent possible, qualified Filipino personnel in all types of mining operations for which they are qualified; and after Commercial Production commences shall, in consultation and with consent of the Government, prepare and undertake an extensive training programme suitable to Filipino nationals in all levels of employment. The objective of said programme is to reach within the timetable set forth below the following targets of "Filipinization:"

	Unskilled (%)	Skilled (%)	Clerical (%)	Professional (%)	Management (%)
Year 1	100	100	100	75	75
Year 3	100	100	100	80	80
Year 5	100	100	100	90	90
Year 7	100	100	100	95	95
Year 10	100	100	100	95	95
Year 15	100	100	100	95	95

10.2 Cost and expenses of training such Filipino personnel and the Contractor's own employees shall be included in the Operating Expenses.

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10.3 The Contractor shall not discriminate on the basis of gender and shall respect the right of women workers to participate in policy and decision-making processes affecting their rights and benefits.

SECTION XI

ARBITRATION

11.1. The Government and the Contractor shall consult with each other in good faith and shall exhaust all available remedies to settle any and all disputes or disagreements arising out of or relating to the validity, interpretations, enforceability, or performance of this Agreement before resorting to arbitration as provided for in Section 11.2. below.

11.2. Any disagreement or dispute which can not be settled amicably within a period of one (1) year from the time the issue is raised by a Party shall be settled by a tribunal of three (3) arbitrators. This tribunal shall be constituted as follows: one to be appointed by the Contractor and the other to be appointed by the Secretary. The first two appointed arbitrators shall consider names of qualified persons until agreement on a mutually acceptable Chairman of the tribunal is selected. Such arbitration shall be initiated and conducted pursuant to Republic Act No. 876, otherwise known as the "Arbitration Act."

In any event, the arbitration shall be conducted applying the substantive laws of the Republic of the Philippines.

11.3. Each party shall pay fifty percent (50%) of the fees and expenses of the Arbitrators and the costs of arbitration. Each party shall pay its own costs and attorney's fee.

SECTION XII

SUSPENSION OR TERMINATION OF CONTRACT, TAX INCENTIVES AND CREDITS

12.1. This Agreement may be suspended for failure of the Contractor: (a) to comply with any provision or requirement of the Act and/or its implementing rules and regulations; (b) to pay on time the complete taxes, fees and/or other charges demandable and due the Government.

12.2. This Agreement terminates or may be terminated for the following causes: (a) expiration of its term, whether original or renewal; (b) withdrawal from the Agreement by the Contractor; (c) violation by the Contractor of the Agreement's terms and conditions; (d) failure to pay taxes, fees/or charges or financial obligations for two (2) consecutive years; (e) false statement or omission of facts by the Contractor; and (f) any other cause or reason provided under the Act and its implementing rules and regulations, or any other relevant laws and regulations.

12.3. All statements made in this Agreement shall be considered as conditions and essential parts hereof, and any falsehood in said statements or omission of facts which may alter, change or affect substantially the fact set forth in said statements shall be a ground for its revocation and termination.

12.4. The Contractor may, by giving due notice at any time during the term of this Agreement, apply for its cancellation due to causes which, in the opinion of the Contractor, render continued mining operation no longer feasible or viable. In this case, the Secretary shall decide on the application within thirty (30) days from notice: Provided, That the Contractor has met all the financial, fiscal and legal obligations.

12.5. No delay or omissions or course of dealing by the Government shall impair any of its rights under this Agreement, except in the case of a written waiver. The Government's right to seek recourse and relief by all other means shall not be construed as a waiver of any succeeding or other default unless the contrary intention is reduced in writing and signed by the party authorized to exercise the waiver.

12.6. In case of termination, the Contractor shall pay all the fees and other liabilities due up to the end of the year in which the termination becomes effective. The Contractor shall immediately carry out the restoration of the Contract Area in accordance with good mining industry practice.

12.7. The withdrawal by the Contractor from the Mineral Agreement shall not release it from any and all financial, environmental, legal and fiscal obligations under this Agreement.

12.8. The following acts or omission, *inter alia* shall constitute breach of contract, upon which the Government may exercise its right to terminate the Agreement:

a. Failure of the Contractor without valid reason to commence Commercial Production within the period prescribed; and/or

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b. Failure of the Contractor to conduct mining operations and other activities in accordance with the approved Work Programs and/or any modification thereof as approved by the Director.

12.9. The Government may suspend and cancel tax incentives and credits if the Contractor fails to abide by the terms and conditions of said incentives and credits.

SECTION XIII

OTHER PROVISIONS

13.1. Any terms and conditions resulting from repeal or amendment of any existing laws or regulation or from the enactment of a law, regulation or administrative order shall be considered a part of this Agreement.

13.2. Notice

All notices, demands and other communications required or permitted hereunder shall be made in writing, telex or telecopy and shall be deemed to have been duly given notice, in the case of telex or telecopy, if answered back or confirmation received, or if delivered by hand, upon receipt or ten days after being deposited in the mail, airmail postage prepaid and addressed as follows:

If to the Government:

THE SECRETARY
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DENR Building, Visayas Avenue
Diliman, Quezon City

If to the Contractor:

THE PRESIDENT
ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION
6th Flr., Quad Alpha Centrum
125 Pioneer St., Mandaluyong City

Either party may substitute or change such address on notice thereof to the other party.

13.3. Governing Law

This Agreement and the relation between the parties hereto shall be governed by and construed in accordance with the laws of the Republic of the Philippines. The Contractor hereby agrees and obliges itself to comply with the provisions of the Act, its implementing rules and regulations and other relevant laws and regulations.

13.4. Suspension of Obligation

a. Any failure or delay on the part of any party in the performance of its obligation or duties hereunder shall be excused to the extent attributable to *Force Majeure* as defined in the Act: Provided, That the suspension of Mining Operations due to *Force Majeure* causes shall be subject to approval by the Director.

b. If Mining Operations are delayed, curtailed or prevented by such *Force Majeure* causes, then the time for enjoying the rights and carrying out the obligations thereby affected, the term of this Agreement and all rights and obligations hereunder shall be extended for a period equal to the period involved.

c. The Party, whose ability to perform its obligations is affected by such *Force Majeure* causes, shall promptly give Notice to the other in writing of any such delay or failure of performance, the expected duration thereof and its anticipated effect and shall use its efforts to remedy such delay, except that neither Party shall be under any obligation to

settle a labor dispute: Provided, That the suspension of obligation by the Contractor shall be subject to prior approval by the Director.

13.5. Amendments

This Agreement shall not be annulled, amended or modified in any respect except by mutual consent in writing of the herein parties.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement, as of the day and year first above written

THE REPUBLIC OF THE PHILIPPINES

BY:

MICHAEL T. DEFENSOR
Secretary
Department of Environment and Natural Resources

ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION, HEIRS OF JOSE P. VELEZ, HEIRS OF MANUEL CUENCO, ANTONIO V. CUENCO & JON RAMON ABOITIZ

BY:

ALFREDO C. RAMOS
President
Atlas Consolidated Mining and Development Corporation

SIGNED IN THE PRESENCE OF:

(Signature over Printed Name)

(Signature over Printed Name)

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ACKNOWLEDGMENT

Republic of the Philippines)
Quezon City) s s

Before me, a Notary Public for and in the City of Quezon, personally appeared **MICHAEL T. DEFENSOR**, with Community Tax Certificate No. 15653147 issued on January 5, 2005 at Quezon City, in his capacity as Secretary of the Department of Environment and Natural Resources, and **ALFREDO C. RAMOS,** with Community Tax Certificate No. 6022596 issued on January 5, 2005 at Manila, in his capacity as President, of Atlas Consolidated Mining and Development Corporation, both known to me and to me known to be the same persons who executed the foregoing instrument consisting of twenty (20) pages, including this acknowledgment page, and acknowledged to me that the same is their voluntary acts and deeds.

IN WITNESS WHEREOF, I have hereunto set my hand and affix my notarial seal, this 05 MAY 2005 day of _____.

JEWELYNE V. [illegible]-CARREON
Notary Public
Until December 31, 05
IBP O.R. No. 677601; 1-7-05 Mla.
PTR O.R. No. 360785; 1-7-05; Mla.
TIN No. [illegible]

Doc. No. 225
Page No. 46
Book No. I
Series of 2005

Certificate of Registration
[illegible] Bureau
[illegible] VII
[illegible]

This certifies that the Memorandum of Agreement entered into by and between the Philippine Government represented by the Department of Environment and Natural Resources and Atlas Consolidated Mining and Development Corporation was received and recorded in this Bureau on the 16th day of June 2005 at 10:30 o'clock in the morning and is recorded in the Regional Production Sharing Agreement Book No. 221 of the Records of this Office, page 13.

Issued upon payment under Official Receipt No. 2554707 in the amount of P20,000 dated June 16 2005.

ROGER [illegible] DIOS
Chief Science Research Specialist
officer-in-Charge

MINERAL PRODUCTION SHARING AGREEMENT
No. 264-2008-VII

This **MINERAL PRODUCTION SHARING AGREEMENT** is made and entered into in Quezon City, Philippines, this _____ day of JUL 09 2008 by and between:

THE REPUBLIC OF THE PHILIPPINES, herein referred to as the **GOVERNMENT**, represented in this act by the Secretary of the Department of Environment and Natural Resources, with offices at the Department of Environment and Natural Resources Building, Visayas Avenue, Diliman, Quezon City

and

ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION, and ANATOLIA JACA, ASTERIO BUQUERON, CRISTETA C. BAGANO, LUCILA PASCUAL, MERCEDES AYTONA, REGINA DE VERA, RICARDO A. VERCHES AND BIGA COPPER MINES, INC., as represented herein by **ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION** hereinafter collectively referred to as the **CONTRACTOR,** a corporation duly organized and existing under the laws of the Republic of the Philippines, with office at 7th F, Quad Alpha Centrum No. 125 Pioneer St., Mandaluyong City, Metro Manila, and represented in this act by its Chairman and President, Mr. Alfredo C. Ramos, as authorized by its Board of Directors (please refer to ANNEX "A")

WITNESSETH :

WHEREAS, the 1987 Constitution of the Republic of the Philippines provides in Article XII, Section 2 thereof that all lands of the public domain, waters, minerals, coal, petroleum and other natural resources are owned by the State and that their exploration, development and utilization shall be under the full control and supervision of the State;

WHEREAS, the Constitution further provides that the State may directly undertake such activities, or it may enter into a Co-Production, Joint Venture, or Mineral Production Sharing Agreement with Filipino citizens, or cooperatives, partnerships, corporations or associations at least sixty per centum of whose capitalization is owned by such citizens;

WHEREAS, pursuant to Republic Act No. 7942, otherwise known as "The Philippine Mining Act of 1995," which took effect on 09 April 1995, the Secretary of the Department of Environment and Natural Resources is authorized to enter into Mineral Production Sharing Agreements in furtherance of the objectives of the Government and the Constitution to bolster the national economy through sustainable and systematic development and utilization of mineral lands;

WHEREAS, Atlas Consolidated Mining and Development Corporation, is a mining lessee and mining applicant, and Anatolia Jaca, Asterio Buqueron, Cristeta C. Bagano, Lucila Pascual, Mercedes Aytona, Regina de Vera, Ricardo A. Verches and Biga Copper Mines, Inc., are mining applicants under previous mining laws;

WHEREAS, Anatolia Jaca, *et. al.*, have authorized ACMDC in filing and securing approval of their mining applications pursuant to their operating agreements with ACMDC;

WHEREAS, the Government desires to avail itself of the financial resources, technical competence and skill, which the Contractor is capable of applying to the mining operations of the project contemplated herein;

WHEREAS, the Contractor desires to join and assist the Government in the initial rational exploration and possible development and utilization for commercial purposes of *copper, gold and other associated mineral deposits* existing in the Contract Area (as herein defined);

WHEREAS, the Contractor has access to all the financing, technical competence, technology and environmental management skills required to promptly and effectively carry out the objectives of this Agreement;

NOW, THEREFORE, for and in consideration of the foregoing premises, the mutual covenants, terms and conditions hereinafter set forth, it is hereby stipulated and agreed as follows:

SECTION I

SCOPE

1.1. This Agreement is a Mineral Production Sharing Agreement entered into pursuant to the provisions of the Act and its implementing rules and regulations. The primary purpose of this Agreement is to provide for the rational exploration, development and commercial utilization of *copper, gold and other associated mineral deposits* existing within the Contract Area, with all necessary services, technology and financing to be furnished or arranged by the Contractor in accordance with the provisions of this Agreement. The Contractor shall not, by virtue of this Agreement, acquire any title over the Contract/Mining Area without prejudice to the acquisition by the Contractor of the land/surface rights through any mode of acquisition provided for by law.

1.2. The Contractor shall undertake and execute, for and on behalf of the Government, sustainable mining operations in accordance with the provisions of this Agreement, and is hereby constituted and appointed, for the purpose of this Agreement, as the exclusive entity to conduct mining operations in the Contract Area.

1.3. The Contractor shall assume all the exploration risk such that if no minerals in commercial quantity are developed and produced, it will not be entitled to reimbursement.

1.4. During the term of this Agreement, the total value of production and sale of minerals derived from the mining operations contemplated herein shall be accounted for and divided between the Government and the Contractor in accordance with Section VIII hereof.

SECTION II

DEFINITIONS

As used in this Agreement, the following words and terms, whether singular or plural, shall have the following respective meaning:

2.1. Act refers to Republic Act No. 7942, otherwise known as the "Philippine Mining Act of 1995."

2.2. Agreement means this Mineral Production Sharing Agreement.

2.3. Associated Minerals mean other ores/minerals, which occur together with the principal ore/mineral.

2.4. Bangko Sentral means Bangko Sentral ng Pilipinas.

2.5. Budget means an estimate of expenditures to be made by Contractor in mining operations contemplated hereunder to accomplish the Work Program for each particular period.

2.6. Bureau means Mines and Geosciences Bureau.

2.7. Calendar Year or Year means a period of twelve (12) consecutive months starting with the first day of January and ending on December 31, while "Calendar Quarter" means a period of three consecutive months with the first calendar quarter starting with the first day of January.

2.8. Commercial Production means the production of sufficient quantity of minerals to sustain economic viability of mining operations reckoned from the date of commercial operation as declared by the Contractor or as stated in the feasibility study, whichever comes first.

2.9. Constitution or Philippine Constitution means the 1987 Constitution of the Republic of the Philippines adopted by the Constitutional Convention of 1986 on October 15, 1986 and ratified by the People of the Republic of the Philippines on February 2, 1987.

2.10. Contract Area means the area onshore or offshore delineated under the Mineral Production Sharing Agreement subject to the relinquishment obligations of the Contractor and properly defined by latitude and longitude or bearing and distance.

2.11. Contract Year means a period of twelve (12) consecutive months counted from the Effective Date of this Agreement or from the anniversary of such Effective Date.

2.12. Contractor means Atlas Consolidated Mining and Development Corporation and Anatolia Jaca, Asterio Buqueron, Criteta Bagano, Lucila Pascual, Mercedes Aytona, Regina de Vera, Ricardo Verches and Biga Copper Mines, Inc. as represented herein by Atlas Consolidated Mining and Development Corporation or their respective assignee(s) or assignees of interest under this Agreement: Provided, That the assignment of any of

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such interest is accomplished pursuant to the pertinent provisions of the implementing rules and regulations of the Act.

2.13. Declaration of Mining Project Feasibility means a document proclaiming the presence of minerals in a specific site, which are recoverable by socially acceptable, environmentally safe and economically sound methods specified in the Mine Development Plan.

2.14. Department or DENR means the Department of Environment and Natural Resources.

2.15. Director means the Director of Mines and Geosciences Bureau.

2.16. Effective Date means the date of execution of this Agreement by the Contractor and by the Secretary on behalf of the Government.

2.17. Environment means all facets of man's surroundings: physical, ecological, aesthetic, cultural, economic, historic, institutional and social.

2.18. Exploration means searching or prospecting for mineral resources by geological, geophysical and geochemical surveys, remote sensing, test pitting, trenching, drilling, shaft sinking, tunneling or any other means for the purpose of determining the existence, extent, quality and quantity of mineral resources and the feasibility of mining them for profit.

2.19. Exploration Period shall mean the period from the Effective Date of this Agreement, which shall be for two (2) years, renewable for like periods but not to exceed a total term of six (6) years for nonmetallic minerals and eight (8) years for metallic minerals, subject to the pertinent provisions of the implementing rules and regulations of the Act.

2.20. Force Majeure means acts or circumstances beyond the reasonable control of the Contractor including, but not limited to war, rebellion, insurrection, riots, civil disturbances, blockade, sabotage, embargo, strike, lockout, any dispute with surface owners and other labor disputes, epidemics, earthquake, storm, flood or other adverse weather conditions, explosion, fire, adverse action by the Government or by any of its instrumentality or subdivision thereof, act of God or any public enemy and any cause as herein described over which the affected party has no reasonable control.

2.21. Foreign Exchange means any currency other than the currency of the Republic of the Philippines acceptable to the Government and the Contractor.

2.22. Government means the Government of the Republic of the Philippines or any of its agencies and instrumentalities.

2.23. Gross Output means the actual market value of the minerals or mineral products from each mine or mineral land operated as a separate entity, without any deduction for mining, processing, refining, transporting, handling, marketing or any other expenses: Provided, That if the minerals or mineral products are sold or consigned abroad by the Contractor under C.I.F. terms, the actual cost of ocean freight and insurance shall be

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deducted: Provided further, That in the case of mineral concentrates which are not traded in commodity exchanges in the Philippines or abroad such as copper concentrate, the actual market value shall be the world price quotation of the refined mineral products contained thereof prevailing in the said commodity exchanges, after deducting the smelting, refining, treatment, insurance, transportation and other charges incurred in the process of converting mineral concentrates into refined metal traded in those commodity exchanges.

2.24. Mine Development refers to work undertaken to prepare an ore body or a mineral deposit for mining, including the construction of necessary infrastructure and related facilities.

2.25. Minerals mean all naturally occurring inorganic substances in solid, liquid, gas or any intermediate state excluding energy materials such as coal, petroleum, natural gas, radioactive materials and geothermal energy.

2.26. Mineral Products mean materials derived from mineral ores/rocks and prepared into marketable state by metallurgical processes which include beneficiation, cyanidation, leaching, smelting, calcination and other similar processes.

2.27. Mining Area means that portion of the Contract Area identified by the Contractor as defined and delineated in a Survey Plan duly approved by the Director/Regional Director concerned for purposes of development and/or utilization and sites for support facilities.

2.28. Mining Operations means mining activities involving exploration, feasibility study, environmental impact assessment, development, utilization, mineral processing and mine rehabilitation.

2.29. Notice means notice in writing, telex or telecopy (authenticated by answer back or confirmation received) addressed or sent as provided in Section 16.2 of this Agreement.

2.30. Ore means naturally occurring substance or material from which a mineral or element can be mined and/or processed for profit.

2.31. Pollution means any alteration of the physical, chemical and/or biological properties of any water, air and/or land resources of the Philippines, or any discharge thereto of any liquid, gaseous or solid wastes or any production of unnecessary noise or any emission of objectionable odor, as will or is likely to create or render such water, air, and land resources harmful, detrimental or injurious to public health, safety or welfare or which will adversely affect their utilization for domestic, commercial, industrial, agricultural, recreational or other legitimate purposes.

2.32. Secretary means the Secretary of the Department of Environment and Natural Resources.

2.33. State means the Republic of the Philippines.

2.34. Work Program means a document which presents the plan of major mining operations and the corresponding expenditures of the Contractor in its Contract Area during a given period of time, including the plan and

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expenditures for development of host and neighboring communities and of local geoscience and mining technology, as submitted and approved in accordance with the implementing rules and regulations of the Act.

SECTION III

TERM OF AGREEMENT

3.1. This Agreement shall have a term of twenty-five (25) years from Effective Date, and may be renewed thereafter for another term not exceeding twenty-five (25) years. The renewal of this Agreement, as well as the changes in the terms and conditions thereof, shall be upon mutual consent by the parties. In the event the Government decides to allow mining operations thereafter by other Contractor, this must be through competitive public bidding. After due publication of notice, the Contractor shall have the right to equal the highest bid upon reimbursement of all reasonable expenses of the highest bidder.

SECTION IV

CONTRACT AREA

4.1. Size, Shape, and Location of Contract Area - This Agreement covers a Contract Area of approximately Six Hundred Forty-Eight and 0159/10,000 (648.0159) hectares in 9 parcels, situated in Toledo City, Cebu, and bounded by the following geographical coordinates (please refer to ANNEX "B" - 1:50,000 scale Location Map/Sketch Plan):

A. For the Whole Area:

CORNERS	LATITUDE	LONGITUDE
1	10° 18' 43.018"	123° 43' 05.196"
2	10° 18' 53.035"	123° 42' 37.399"
3	10° 18' 43.859"	123° 42' 34.028"
4	10° 18' 53.874"	123° 42' 06.231"
5	10° 19' 21.402"	123° 42' 16.344"
6	10° 19' 24.741"	123° 42' 07.078"
7	10° 20' 05.819"	123° 42' 22.170"
8	10° 20' 06.317"	123° 42' 17.371"
9	10° 20' 45.161"	123° 42' 21.489"
10	10° 20' 44.142"	123° 42' 31.296"
11	10° 20' 09.300"	123° 42' 27.602"
12	10° 20' 03.943"	123° 42' 42.467"
13	10° 19' 54.767"	123° 42' 39.095"
14	10° 19' 51.429"	123° 42' 48.361"
15	10° 20' 09.781"	123° 42' 55.105"
16	10° 20' 03.103"	123° 43' 13.637"
17	10° 20' 17.883"	123° 43' 15.480"
18	10° 20' 21.386"	123° 43' 15.480"
19	10° 20' 21.3 86"	123° 43' 23.608"
20	10° 20' 30.001"	123° 43' 23.608"
21	10° 20' 30.000"	123° 43' 27.366"
22	10° 20' 17.882"	123° 43' 27.783"

23	10° 20' 17.883"	123° 43' 15.480"
24	10° 20' 03.103"	123° 43' 13.637"
25	10° 19' 35.576"	123° 43' 03.522"
26	10° 19' 38.914"	123° 42' 54.256"
27	10° 19' 29.738"	123° 42' 50.884"
28	10° 19' 26.400"	123° 43' 00.150"
29	10° 19' 35.576"	123° 43' 03.522"
30	10° 19' 32.236"	123° 43' 12.788"
31	10° 19' 41.412"	123° 43' 16.159"
32	10° 19' 38.074"	123° 43' 25.425"
33	10° 19' 28.898"	123° 43' 22.053"
34	10° 19' 32.236"	123° 43' 12.788"
35	10° 19' 23.060"	123° 43' 09.416"
36	10° 19' 19.722"	123 ° 43' 18.682"
37	10° 19' 28.898"	123° 43' 22.053"
38	10° 19' 25.558"	123° 43' 31.319"
39	10° 19' 29.029"	123° 43' 32.595"
40	10° 19' 29.029"	123° 43' 35.238"
41	10° 19' 48.558"	123° 43' 35.237"
42	10° 19' 48.558"	123° 43' 45.097"
43	10° 20' 08.087"	123° 43' 45.096"
44	10° 20' 09.292"	123° 43' 44.555"
45	10° 20' 09.403"	123° 43' 47.840"
46	10° 20' 12.820"	123° 43' 47.722"
47	10° 20' 12.953"	123° 43' 51.664"
48	10° 20' 15.880"	123° 43' 51.564"
49	10° 20' 19.494"	123° 43' 57.359"
50	10° 20' 48.770"	123° 43' 56.351"
51	10° 20' 48.664"	123° 43' 53.222"
52	10° 20' 50.640"	123° 43' 53.222"
53	10° 20' 50.641"	123° 44' 03.082"
54	10° 20' 40.877"	123° 44' 03.083"
55	10° 20' 40.877"	123° 44' 12.943"
56	10° 20' 35.736"	123° 44' 12.944"
57	10° 20' 35.059"	123° 44' 11.297"
58	10° 20' 26.040"	123° 44' 15.076"
59	10° 20' 22.298"	123° 44' 05.969"
60	10° 20' 17.801"	123° 44' 07.853"
61	10° 20' 14.572"	123° 44' 02.207"
62	10° 20' 06.116"	123° 44' 07.137"
63	10° 20' 01.234"	123° 43' 58.598"
64	10° 19' 52.777"	123° 44' 03.528"
65	10° 19' 47.895"	123° 43' 54.989"
66	10° 19' 39.439"	123° 43' 59.919"
67	10° 19' 29.706"	123° 43' 42.821"
68	10° 19' 22.220"	123° 43' 40.585"
69	10° 18' 54.691"	123° 43' 30.470"
70	10° 18' 58.031"	123° 43' 21.204"
71	10° 18' 39.679"	123° 43' 14.461"

Area: **648.0159 hectares**

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B. PARCEL – 1

Contractor : ACMDC		
Area : 546.2330 Hectares		
CORNER	LATITUDE	LONGITUDE
1	10°18' 43.859"	123°42'34.028"
2	10°18' 53.874"	123°42' 06.231"
3	10°19' 21.402"	123°42' 16.344"
4	10°19' 24.741"	123°42' 07.078"
5	10°20' 05.819"	123°42' 22.170"
6	10°20' 06.317"	123°42' 17.371"
7	10°20' 45.161"	123°42' 21.489"
8	10°20' 44.142"	123°42' 31.296"
9	10°20' 09.300"	123°42' 27.602"
10	10°20' 03.943"	123°42' 42.467"
11	10°19' 54.767"	123°42' 39.095"
12	10°19' 51.429"	123°42' 48.361"
13	10°20' 09.781"	123°42' 55.105"
14	10°20' 03.103"	123°43' 13.637"
15	10°20' 17.883"	123°43' 15.480"
16	10°20' 21.386"	123°43' 15.480"
17	10°20' 21.398"	123°43' 27.662"
18	10°20' 18.527"	123°43' 27.761"
19	10°20' 17.882"	123°43' 27.783"
20	10°20' 17.884"	123°43' 25.341"
21	10°20'17.883"	123°43' 15.480"
22	10°20' 03.103"	123°43' 13.637"
23	10°19' 35.576"	123°43' 03.522"
24	10°19' 38.914"	123°42' 54.256"
25	10°19' 29.738"	123°42' 50.884"
26	10°19' 26.400"	123°43' 00.150"
27	10°19' 35.576"	123°43' 03.522"
28	10°19' 32.236"	123°43' 12.788"
29	10°19' 41.412"	123°43' 16.159"
30	10°19' 38.074"	123°43' 25.425"
31	10°19' 28.898"	123°43' 22.053"
32	10°19' 32.236"	123°43' 12.788"
33	10°19' 23.060"	123°43' 9.416"
34	10°19' 19.722"	123°43' 18.682"
35	10°19' 28.898"	123°43' 22.053"
36	10°19' 32.236"	123°43' 12.788"
37	10°19' 28.898"	123°43' 22.053"
38	10°19' 25.558"	123°43' 31.319"
39	10°19' 29.029"	123°43' 32.595"
40	10°19' 29.029"	123°43' 35.238"
41	10°19' 32.512"	123°43' 35.238"
42	10°19' 38.793"	123°43' 35.237"
43	10°19' 42.712"	123°43' 35.237"
44	10°20' 19.494"	123°43' 57.359"

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45	10°20' 26.230"	123°43' 57.127"
46	10°20' 26.230"	123°43' 59.089"
47	10°20' 26.230"	123°44' 00.026"
48	10°20' 26.230"	123°44' 04.321"
49	10°20' 31.317"	123°44' 2.190"
50	10°20' 35.059"	123°44' 11.297"
51	10°20' 26.040"	123°44' 15.076"
52	10°20' 22.298"	123°44' 5.969"
53	10°20' 22.601"	123°43' 59.671"
54	10°20' 22.645"	123°43' 58.762"
55	10°20' 20.244"	123°43' 58.572"
56	10°20' 19.494"	123°43' 57.359"
57	10°19' 42.712"	123°43' 35.237"
58	10°19' 38.162"	123°43' 37.891"
59	10°19' 29.706"	123°43' 42.821"
60	10°19' 22.220"	123°43' 40.585"
61	10°18' 54.691"	123°43' 30.470"
62	10°18' 58.031"	123°43' 21.204"
63	10°18' 39.679"	123°43' 14.461"
64	10°18' 53.035"	123°42' 37.399"

C. PARCEL - 2

Contractor : Asterio Buqueron		
Area : 13.7760 Hectares		
CORNER	LATITUDE	LONGITUDE
1	10°20' 04.798"	123°43' 45.114"
2	10°20' 08.087"	123°43' 45.096"
3	10°20' 09.292"	123°43' 44.555"
4	10°20' 09.403"	123°43' 47.840"
5	10°20' 12.820"	123°43' 47.722"
6	10°20' 12.953"	123°43' 51.664"
7	10°20' 15.880"	123°43' 51.564"
8	10°20' 17.694"	123°43' 54.483"
9	10°20' 19.494"	123°43' 57.359"
10	10°20' 20.244"	123°43' 58.572"
11	10°20' 22.645"	123°43' 58.762"
12	10°20' 22.298"	123°44' 05.969"
13	10°20' 17.801"	123°44' 07.853"
14	10°20' 14.572"	123°44' 02.207"
15	10°20' 12.128"	123°43' 57.933"
16	10°20' 09.689"	123°43' 53.667"
17	10°20' 04.807"	123°43' 45.128"

D. PARCEL – 3

Contractor : Anatolia Jaca		
Area : 25.9377 Hectares		
CORNER	LATITUDE	LONGITUDE
1	10°19' 34.556"	123°43' 51.380"
2	10°19' 43.044"	123°43' 46.429"
3	10°19' 48.559"	123°43' 43.214"
4	10°19' 48.558"	123°43' 45.097"
5	10°19' 53.559"	123°43' 45.097"
6	10°19' 56.383"	123°43' 50.038"
7	10°20' 01.234"	123°43' 58.598"
8	10°20' 09.689"	123°43' 53.667"
9	10°20' 14.572"	123°44' 02.207"
10	10°20' 06.116"	123°44' 07.137"
11	10°20' 01.234"	123°43' 58.598"
12	10°19' 56.383"	123°43' 50.038"
13	10°19' 47.895"	123°43' 54.989"
14	10°19' 39.439"	123°43' 59.919"

E. PARCEL - 4

Contractor : Cristeta C. Bagano		
Area : 18.0360 Hectares		
CORNER	LATITUDE	LONGITUDE
1	10°19' 29.706"	123°43' 42.821"
2	10°19' 38.162"	123°43' 37.891"
3	10°19' 43.044"	123°43' 46.429"
4	10°19' 47.895"	123°43' 54.989"
5	10°19' 56.383"	123°43' 50.038"
6	10°20' 01.234"	123°43' 58.598"
7	10°19' 52.777"	123°44' 03.528"
8	10°19' 47.895"	123°43' 54.989"
9	10°19' 43.044"	123°43' 46.429"
10	10°19' 34.556"	123°43' 51.380"

F. PARCEL - 5

Contractor : Biga Copper Mines, Inc.		
Area : 21.7797 Hectares		
CORNER	LATITUDE	LONGITUDE
1	10°20' 26.230"	123°43' 57.127"
2	10°20' 29.253"	123°43' 57.022"
3	10°20' 31.112"	123°43' 56.958"
4	10°20' 40.876"	123°43' 56.622"
5	10°20' 48.770"	123°43' 56.351"
6	10°20' 48.664"	123°43' 53.222"
7	10°20' 50.640"	123°43' 53.222"
8	10°20' 50.641"	123°44' 03.082"
9	10°20' 40.877"	123°44' 03.083"
10	10°20' 40.877"	123°44' 12.943"
11	10°20' 35.736"	123°44' 12.944"

12	10°20' 35.059"	123°44' 11.297"
13	10°20' 31.684"	123°44' 03.083"
14	10°20' 31.317"	123°44' 02.190"
15	10°20' 31.112"	123°44' 02.276"
16	10°20' 26.230"	123°44' 04.321"

G. PARCEL – 6

Contractor : Lucila Pascual		
Area : 10.1033 Hectares		
CORNER	**LATITUDE**	**LONGITUDE**
1	10°19' 38.162"	123°43' 37.891"
2	10°19' 42.712"	123°43' 35.237"
3	10°19' 47.920"	123°43' 35.237"
4	10°19' 48.558"	123°43' 36.353"
5	10°19' 48.559"	123°43' 43.214"
6	10°19' 48.558"	123°43' 45.097"
7	10°19' 53.559"	123°43' 45.097"
8	10°20' 04.798"	123°43' 45.114"
9	10°20' 04.807"	123°43' 45.128"
10	10°19' 56.383"	123°43' 50.038"
11	10°19' 53.559"	123°43' 45.097"
12	10°19' 48.558"	123°43' 45.097"
13	10°19' 48.559"	123°43' 43.214"
14	10°19' 43.044"	123°43' 46.429"

H. PARCEL - 7

Contractor : Mercedes Aytona		
Area : 0.03327 Hectare		
CORNER	**LATITUDE**	**LONGITUDE**
1	10°19'48.558"	123°43' 36.353"
2	10°19' 47.920"	123°43' 35.237"
3	10°19' 48.558"	123°43' 35.237"

I. PARCEL – 8

Contractor : Regina de Vera		
Area : 8.9831 Hectares		
CORNER	**LATITUDE**	**LONGITUDE**
1	10°20' 01.234"	123°43' 58.598"
2	10°19' 56.383"	123°43' 50.038"
3	10°20' 04.807"	123°43' 45.128"
4	10°20' 09.689"	123°43' 53.667"

J. PARCEL - 9

Contractor : Ricardo A. Verchez		
Area : 3.1432 Hectares		
CORNERS	LATITUDE	LONGITUDE
1	10°20' 21.386"	123°43' 23.608"
2	10°20' 30.001"	123°43' 23.608"
3	10°20' 30.000"	123°43' 27.366"
4	10°20' 28.286"	123°43' 27.425"
5	10°20' 21.398"	123°43' 27.662"

SECTION V

EXPLORATION PERIOD

5.1. Timetable for Exploration - The Contractor shall commence Exploration activities not later than three (3) months after the Effective Date for a period of two (2) years, renewable for like periods but not to exceed a total term of six (6) years for nonmetallic minerals and eight (8) years for metallic minerals, subject to annual review and approval by the Director in accordance with the implementing rules and regulations of the Act.

5.2. Renewal of Exploration Period - In case the Contractor opts for a renewal of its Exploration Period, it shall file prior to the expiration thereof, a renewal application in the Mines and Geosciences Bureau Central Office, accompanied by the mandatory requirements stipulated in the implementing rules and regulations of the Act. The Director may grant the renewal of the Exploration Period on condition that the Contractor has substantially complied with the terms and conditions of the Agreement.

In cases where further exploration is warranted beyond the six (6) - or eight (8)-year period and on condition that the Contractor has substantially implemented the Exploration and Environmental Work Programs as verified by the Bureau, the Director may further grant renewal of the Exploration Period: Provided, That the Contractor shall be required to set up a performance surety equivalent to the expenditure requirement of the Exploration and Environmental Work Programs.

5.3. Work Programs and Budgets - The Contractor shall strictly comply with the approved Exploration and Environmental Work Programs together with their corresponding Budgets (please refer to ANNEXES "C" and "D").

The amount to be spent by the Contractor in conducting Exploration activities under the terms of this Agreement during the Exploration Period shall be in the aggregate of not less than that specified for each of the Contract Years, as follows:

For the Exploration Work Program:

1st Contract Year	:	PhP 716,000.00
2nd Contract Year	:	PhP 32,469,800.00
Total	:	**PhP 33,185,800.00**
For the Environmental Work Program	:	**PhP 3,422,733.50**

In the event of renewal of the Exploration Period, the amount to be spent every year shall first be agreed upon by the parties.

In the event of termination of this Agreement, the Contractor shall only be obliged to expend the pro-rata amount for the period of such Contract Year prior to termination. If during any Contract Year, the Contractor should expend more than the amount to be expended as provided above, the excess may be subtracted from the amount required to be expended by the Contractor during the succeeding Contract Years, and should the Contractor, due to unforeseen circumstances or with the consent of the Government, expend less during a year, then the deficiency shall be applied to the amount to be expended during the succeeding Contract Years.

5.4. Relinquishment of Total/Portion of the Contract Area - During the Exploration Period, the Contractor may relinquish totally or partially the original Contract Area. After the Exploration Period and prior to or upon approval of a Declaration of Mining Project Feasibility by the Director, the Contractor shall finally relinquish any portion of the Contract Area not necessary for mining operations and not covered by any Declaration of Mining Project Feasibility.

5.5. Final Mining Area - The Director may allow the Contractor to hold more than one (1) final Mining Area subject to the maximum limits set under the implementing rules and regulations of the Act: Provided that each final Mining Area shall be covered by a Declaration of Mining Project Feasibility.

5.6. Declaration of Mining Project Feasibility – Within the term of the Exploration Period, the Contractor shall file in the Regional Office concerned, the Declaration of Mining Project Feasibility of the Contract Area/final Mining Area supported by Mining Project Feasibility Study, Three (3)-Year Development and Construction or Commercial Operation Work Program, complete geologic report, an application for survey and the pertinent Environmental Compliance Certificate, among other applicable requirements. Failure of the Contractor to submit the Declaration of Mining Project Feasibility during the Exploration Period shall be considered a substantial breach of this Agreement.

5.7. Survey of the Contract Area - The Contractor shall cause the survey of the perimeter of the Contract Area/final Mining Area through an application for survey, complete with requirements, filed in the Regional Office concerned simultaneous with the submission of the Declaration of Mining Feasibility. Survey returns shall be submitted to the Regional Director concerned for approval within one (1) year from receipt of the Order of Survey complete

with the mandatory requirements stated in the implementing rules and regulations of the Act.

5.8. Reporting

a. During the Exploration Period, the Contractor shall submit to the Director, through the Regional Director concerned, quarterly and annual accomplishment reports under oath on all activities conducted in the Contract Area from the Effective Date of this Agreement. The quarterly report shall be submitted not later than fifteen (15) days at the end of each Calendar Quarter while the annual accomplishment report shall be submitted not later than thirty (30) days from the end of each Calendar Year. Such information shall include detailed financial expenditures, raw and processed geological, geochemical, geophysical and radiometric data plotted on a map at a minimum 1:50,000 scale, copies of originals of assay results, duplicated samples, field data, copies of originals from drilling reports, maps, environmental work program implementation and detailed expenditures showing discrepancies/ deviations with approved exploration and environmental plans and budgets as well as all other information of any kind collected during the exploration activities. All information submitted to the Bureau shall be subject to the confidentiality clause of this Agreement.

b. Final Report - The Contractor shall submit to the Director, through the Regional Director concerned, a final report under oath upon the expiration of the Exploration Period which shall be in the form and substance comparable to published professional reports of respectable international institutions and shall incorporate all the findings in the Contract Area including location of samples, assays, chemical analysis, and assessment of mineral potentials together with a geologic map of 1:50,000 scale at the minimum showing the results of the exploration. Such report shall also include detailed expenditures incurred during the Exploration Period. In case of diamond drilling, the Contractor shall, upon request of the Director/Regional Director concerned, submit to the Regional Office concerned a quarter of the core samples, which shall be deposited in the Regional Office Core Library for safekeeping and reference.

c. Relinquishment Report - The Contractor shall submit a separate relinquishment report with a detailed geologic report of the relinquished area accompanied by maps at a scale of 1:50,000 and results of analyses and detailed expenditures, among others.

SECTION VI

DEVELOPMENT AND CONSTRUCTION PERIOD

6.1. Timetable - The Contractor shall complete the development of the mine including the construction of production facilities within thirty-six (36) months from the submission and approval of the Declaration of Mining Project Feasibility, subject to such extension based on justifiable reasons as the Director may approve, upon recommendation of the Regional Director concerned.

6.2. Reporting

a. Annual - The Contractor shall submit, within sixty (60) days after December 31 of each year, to the Director, through the Regional Director concerned, an annual report, which states the major activities, achievements and detailed expenditures during the year covered, including maps, assays, rock and mineral analyses and geological and environmental progress reports during the Development and Construction Period.

b. Final Report - Within six (6) months from the completion of the development and construction activities, the Contractor shall submit a final report to the Director, through the Regional Director concerned. Such report shall integrate all information in maps of appropriate scale and quality, as well as in monographs or reports in accordance with international standards.

SECTION VII

OPERATING PERIOD

7.1. Timetable - The Contractor shall submit, within thirty (30) days before completion of mine development and construction of production facilities, to the Director, through the Regional Director concerned, a Three-Year Commercial Operation Work Program. The Contractor shall commence commercial utilization immediately upon approval of the aforesaid Work Program. Failure of the Contractor to commence Commercial Production within the period shall be considered a substantial breach of the Agreement.

7.2. Commercial Operation Work Program and Budget - During the Operating Period, the Contractor shall submit to the Director, through the Regional Director concerned, Work Programs and Budgets covering a period of three (3) years each, which shall be submitted not later than thirty (30) days before the expiration of the period covered by the previous Work Program.

The Contractor shall conduct Mining Operations and other activities for the duration of the Operating Period in accordance with the duly approved Work Programs and corresponding Budgets.

7.3. Expansion and Modification of Facilities - The Contractor may make expansions, modifications, improvements, and replacements of the mining facilities and may add new facilities as the Contractor may consider necessary for the operations: Provided, That such plans shall be embodied in an appropriate Work Program approved by the Director.

7.4. Reporting

a. Quarterly Reports - Beginning with the first Calendar Quarter following the commencement of the Operating Period, the Contractor shall submit, within thirty (30) days after the end of each Calendar Quarter, to the Director, through the Regional Director concerned, a Quarterly Report stating the tonnage of production in terms of ores, concentrates, and their corresponding grades and other types of

products; value, destination of sales or exports and to whom sold; terms of sales and expenditures.

b. Annual Reports - During the Operating Period, the Contractor shall submit within sixty (60) days from the end of each Calendar Year, to the Director, through the Regional Director concerned, an Annual Report indicating in sufficient detail:

b.1. The total tonnage of ore reserves, whether proven, probable, or inferred, the total tonnage of ores, kind by kind, broken down between tonnage mined, tonnages transported from the minesite and their corresponding destination, tonnages stockpiled in the mine and elsewhere in the Philippines, tonnages sold or committed for export (whether actually shipped from the Philippines or not), tonnages actually shipped from the Philippines (with full details as to purchaser, destination and terms of sale), and if known to the Contractor, tonnages refined, processed or manufactured in the Philippines with full specifications as to the intermediate products, by-products or final products and of the terms at which they were disposed;

b.2. Work accomplished and work in progress at the end of the year in question with respect to all the installations and facilities related to the utilization program, including the investment actually made or committed; and

b.3. Profile of work force, including management and staff, stating particularly their nationalities, and for Filipinos, their place of origin (i.e., barangay, town, province, region).

The Contractor shall also comply with other reporting requirements provided for in the implementing rules and regulations of the Act.

SECTION VIII

FISCAL REGIME

8.1. General Principle - The fiscal regime of this Agreement shall be governed by the principle according to which the Government expects a reasonable return in economic value for the utilization of non-renewable mineral resources under its national sovereignty while the Contractor expects a reasonable return on its investment with special account to be taken for the high risk of exploration, the terms and conditions prevailing elsewhere in the industry and any special efficiency to be gained by a particularly good performance of the Contractor.

8.2. Registration Fees - Within fifteen (15) days upon receipt of the notice of approval of the Agreement from the Regional Office concerned, the Contractor shall cause the registration of this Agreement with the said Regional Office and pay the registration fee at the rate provided in the existing rules and regulations. Failure of the Contractor to cause the registration of this Agreement within the prescribed period shall be sufficient ground for cancellation of the same.

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8.3. Occupation Fees - Prior to registration of this Agreement and at the same date every year thereafter, the Contractor shall pay to the Municipal/City Treasurer concerned an occupation fee over the Contract Area at the annual rate provided in the existing rules and regulations. If the fee is not paid on the date specified, the Contractor shall pay a surcharge of twenty five percent (25%) of the amount due in addition to the occupation fees.

8.4. Share of the Government - The Government Share shall be the excise tax on mineral products at the time of removal and at the rate provided for in Republic Act No. 7729 amending Section 151 (a) of the National Internal Revenue Code, as amended, as well as other taxes, duties and fees levied by existing laws. The Excise Tax shall be timely and completely paid to the nearest Bureau of Internal Revenue Office in the province concerned. For purposes of determining the amount of the herein Government Share, the Contractor shall strictly comply with the auditing and accounting requirements prescribed under existing laws and regulations.
The Government Share shall be allocated in accordance with Sections 290 and 292 of Republic Act No. 7160, otherwise known as "The Local Government Code of 1991."

8.5. Pricing of Sales - The Contractor shall dispose of the minerals and by-products produced at the highest market price prevailing in the locality. The Contractor shall also pay the lowest achievable marketing commissions and related fees and shall negotiate for more advantageous terms and conditions subject to the right to enter into long-term sales or marketing contracts or foreign exchange and commodity hedging contracts, which the Government acknowledges to be acceptable notwithstanding that the sale price of the minerals and by-products may from time to time be lower, or the terms and conditions of sales are less favorable, than that available elsewhere. The Contractor shall seek to strike a balance between long-term sales or marketing contracts or foreign exchange and commodity hedging contracts comparable to policies followed by independent producers in the international mining industry.

The Contractor shall likewise seek a balanced distribution among consumers. Insofar as sales to Contractor's affiliate(s) are concerned, prices shall be at arm's length standard, and competing offers for large scale and long-term contracts shall be procured. Before any sale and/or shipment of mineral product is made, existing and future marketing contract(s)/sales agreement(s) shall be submitted to the Director, copy furnished the Regional Director concerned, for registration. At the same time, the Contractor shall regularly inform the Director in writing of any revisions, changes or additions in said contract(s)/agreement(s).

The Contractor shall reflect in its Monthly/Quarterly Report on Production, Sales and Inventory of Minerals, as well as in the Integrated Annual Report, the corresponding registration number(s) of the marketing contract(s)/agreement(s) governing the export or sale of minerals.

8.6. Associated Minerals - If minerals other than *copper, gold and other associated mineral deposits* are discovered in commercial quantities in the Contract Area, the value thereof shall be added to the value of the principal mineral in computing the Government share.

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SECTION IX

WORK PROGRAMS

9.1. Submission to Government - Within the periods stated herein, the Contractor shall prepare and submit to the Director, through the Regional Director concerned, a Work Program and corresponding Budget for the Contract Area stating the Mining Operations and expenditures which the Contractor proposes to carry out during the period covered with the details and particulars set forth elsewhere in this Agreement or in the supporting documents.

9.2. Government's Examination and Revision of Work Program - Should the Government decide to propose a revision to a certain specific feature in the Work Program or Budget, it shall, within thirty (30) days after receipt thereof, provide a Notice to the Contractor specifying in reasonable detail its reasons therefore. Promptly thereafter, the Government and Contractor will meet and endeavor to agree on the revision proposed by the Government. In any event, the revision of any portion of said Work Program or Budget in which the Government shall fail to notify the Contractor of the proposed revision shall, insofar as possible, be carried out as prescribed herein. If the Government should fail within sixty (60) days from receipt thereof to notify Contractor of the proposed revisions, the Work Program and Budget proposed by the Contractor shall be deemed to be approved.

9.3. Contractor's Changes to Work Program - It is recognized by the Government and the Contractor that the details of any Work Program may require changes in the light of changing circumstances. The Contractor may make such changes: Provided, That it shall not change the general objective of the Work Program: Provided further, That changes which entail a negative variance of at least twenty percent (20%) shall be subject to the approval of the Director.

In case of any positive variance, the Contractor shall submit to the Director, through the Regional Director concerned, a copy each of the Work Programs, for information.

9.4. The Government's approval of a proposed Work Program and Budget will not be unreasonably withheld.

SECTION X

ENVIRONMENTAL PROTECTION AND MINE SAFETY AND HEALTH

10.1. The Contractor shall manage its Mining Operations in a technically, financially, socially, culturally and environmentally responsible manner to achieve the sustainable development objectives and responsibilities as provided for under the implementing rules and regulations of the Act.

10.2. The Contractor shall ensure that the standards of environmental protection are met in the course of the Mining Operations. To the extent possible, control of pollution and the transformation of the mined-out areas or

materials into economically and socially productive forms must be done simultaneously with mining.

10.3. The Contractor shall submit an Environmental Work Program during the Exploration Period as prescribed in the implementing rules and regulations of the Act.

10.4. An Environmental Compliance Certificate (ECC) shall be secured first by the Contractor prior to the conduct of any development works, construction of production facilities and/or mine production activities in the Contract Area.

10.5. The Contractor shall submit within thirty (30) calendar days after the issuance and receipt of the ECC, an Environmental Protection and Enhancement Program (EPEP) using MGB Form No. 16-2 covering all areas to be affected by development, utilization and processing activities under this Agreement. The Contractor shall allocate for its initial environment-related capital expenditures approximately ten percent (10%) of the total project cost or in such amount depending on the environmental/geological condition, nature and scale of operations and technology to be employed in the Contract Area.

10.6. The Contractor shall submit, within thirty (30) days prior to the beginning of every calendar year, an Annual Environmental Protection and Enhancement Program (AEPEP), using MGB Form 16-3, which shall be based on the approved EPEP. The AEPEP shall be implemented during the year for which it was submitted. To implement its AEPEP, the Contractor shall allocate annually three to five percent (3%-5%) of its direct mining and milling costs depending on the environmental/geologic condition, nature and scale of operations and technology employed in the Contract Area.

10.7. The Contractor shall establish a Contingent Liability and Rehabilitation Fund (CLRF) which shall be in the form of the Mine Rehabilitation Fund (MRF) and the Mine Waste and Tailings Fee (MWTF).

The MRF shall be based on the financial requirements of the approved EPEP as a reasonable environmental deposit to ensure satisfactory compliance with the commitments/strategies of the EPEP/AEPEP and availability of funds for the performance of the EPEP/AEPEP during the specific project phase. The MRF shall be deposited as Trust Fund in a government depository bank and shall be used for physical and social rehabilitation of areas affected by mining activities and for research on the social, technical and preventive aspects of rehabilitation.

The MWTF shall be collected based on the amounts of mine waste and mill tailings generated during the conduct of Mining Operations. The MWTF collected shall accrue to a Mine Waste and Tailings Reserve Fund and shall be deposited in a government depository bank for payment of compensation for damages caused by the Mining Operations.

10.8. The Contractor shall set up mitigating measures such as mine waste and mill tailings disposal system, mine rehabilitation or plan, water quality

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monitoring, etc. to minimize land degradation, air and water pollution, acid rock drainage and changes in hydrogeology.

10.9. The Contractor shall set up an Environmental and Safety Office at its minesite manned by qualified personnel to plan, implement and monitor its approved EPEP.

10.10. The Contractor shall be responsible in the monitoring of environmental, safety and health conditions in the Contract Area and shall strictly comply with all the rules and regulations embodied under DAO No. 2000-98, otherwise known as the "Mine Safety and Health Standards."

10.11. The Contractor shall be responsible for the submission of a final mine rehabilitation and/or decommissioning plans, including its financial requirements and incorporating the details and particulars set forth in the implementing rules and regulations of the Act.

SECTION XI

RIGHTS AND OBLIGATIONS OF THE PARTIES

11.1. Obligations of the Contractor:

a. To exclusively conduct sustainable Mining Operations within the Contract Area in accordance with the provisions of the Act and its implementing rules and regulations;

b. To construct and operate any facilities specified under the Mineral Agreement or approved Work Program;

c. To determine the exploration, mining and treatment process to be utilized in the Mining Operations;

d. To extract, remove, use and dispose of any tailings as authorized by an approved Work Program;

e. To secure all permits necessary or desirable for the purpose of Mining Operations;

f. To keep accurate technical records about the Mining Operations, as well as financial and marketing accounts, and make them available to Government representatives authorized by the Director for the purpose of assessing the performance and compliance of the Contractor with the terms of this Agreement. Authorized representatives of other Government Agencies may also have access to such accounts in accordance with existing laws, rules and regulations;

g. To furnish the Bureau all the data and information gathered from the Contract Area and that all the books of accounts and records shall be open for inspection;

h. To allow access to Government during reasonable hours in inspecting the Contract Area and examining pertinent records for purposes of monitoring compliance with the terms of this Agreement;

i. To hold the Government free and harmless from all claims and accounts of all kinds, as well as demands and actions arising out of the accidents or injuries to persons or properties caused by Mining Operations of the Contractor and indemnify the Government for any expenses or costs incurred by the Government by reason of any such claims, accounts, demands or actions;

j. In the development of the community:

j.1. To recognize and respect the rights, customs and traditions of indigenous cultural communities over their ancestral lands and to allocate royalty payment of not less than one percent (1%) of the value of the gross output of minerals sold;

j.2. To coordinate with proper authorities in the development of the mining community and for those living in the host and neighboring communities through social infrastructure, livelihood programs, education, water, electricity and medical services. Where traditional self-sustaining income and the community activities are identified to be present, the Contractor shall assist in the preservation and/or enhancement of such activities;

j.3. To allot annually a minimum of one percent (1%) of the direct mining and milling costs necessary to implement the activities undertaken in the development of the host and neighboring communities. Expenses for community development may be charged against the royalty payment of at least one percent (1%) of the gross output intended for the concerned indigenous cultural community;

j.4. To give preference to Filipino citizens who have established domicile in the neighboring communities, in the hiring of personnel for its mining operations. If necessary skills and expertise are currently not available, the Contractor must immediately prepare and undertake a training and recruitment program at its expense; and

j.5. To incorporate in the Mining Project Feasibility Study the planned expenditures necessary to implement (j.1) to (j.3) of this Section;

k. In the development of Mining Technology and Geosciences:

k.1. In the course of its operations, to produce geological, geophysical, geochemical and other types of maps and reports that are appropriate in scale and in format and substance which are consistent with the internationally accepted standards and practices. Such maps shall be made available to the scientific community in the most convenient

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and cost effective forms, subject to the condition that the Contractor may delay release of said information for a reasonable period of time which shall not exceed three (3) years;

k.2. To systematically keep the data generated from the Contract/ Mining Area such as cores, assays and other related information, including economic and financial data and make them accessible to students, researchers and other persons responsible for developing mining, geoscience and processing technology subject to the condition that the Contractor may delay release of data to the science and technology community within a reasonable period of time which shall not exceed three (3) years;

k.3. To transfer to the Government or local mining company the appropriate technology it may adapt in the exploration, development and commercial utilization of the minerals in the Contract Area;

k.4. To allocate research and development budget for the advancement of mining technology and geosciences in coordination with the Bureau, research institutions, academe, etc.; and

k.5. To replicate data, maps and reports cited in (k.1) and (k.2) and furnish the Bureau for archiving and systematic safekeeping which shall be made available to the science and technology community for conducting research and undertaking other activities which contribute to the development of mining, geoscience and processing technology and the corresponding national pool of manpower talents: Provided, however, that the release of data, maps and the like shall be similarly constrained in accordance with (k.1) and (k.2) above;

l. To incorporate in the Mining Feasibility Study the planned expenditures necessary to implement all the plans and programs set forth in this Agreement; and

m. To pay all other taxes and fees mandated by existing laws, rules and regulations.

11.2. Rights of the Contractor:

a. To conduct Mining Operations within the confines of its Contract/Mining Area in accordance with the terms and conditions hereof and without interfering with the rights of other Contractors/Lessees/Operators/ Permittees/Permit Holders;

b. Possession of the Contract Area, with full right of ingress and egress and the right to occupy the same, subject to surface and easement rights;

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c. To use and have access to all declassified geological, geophysical, drilling, production and other data relevant to the mining operations;

d. To sell, assign, transfer, convey or otherwise dispose of all its rights, interests and obligations under the Agreement subject to the approval of the Government;

e. To employ or bring into the Philippines foreign technical and specialized personnel, including the immediate members of their families as may be required in the operations of the Contractor, subject to applicable laws and regulations: Provided, That if the employment connection of such foreign persons with the Contractor ceases, the applicable laws and regulations on immigration shall apply to them. Every time foreign technologies are utilized and where alien executives are employed, an effective program of training understudies shall be undertaken. The alien employment shall be limited to technologies requiring highly specialized training and experience subject to the required approval under existing laws, rules and regulations;

f. To enjoy easement rights and use of timber, water and other natural resources in the Contract Area subject to pertinent laws, rules and regulations and the rights of third parties;

g. Repatriation of capital and remittance of profits, dividends and interest on loans, subject to existing laws and Bangko Sentral ng Pilipinas rules and regulations; and

h. To import when necessary all equipment, spare parts and raw materials required in the operations in accordance with existing laws and regulations.

11.3. Obligations of the Government:

a. To ensure that the Contractor has the Government's full cooperation in the exercise of the rights granted to it under this Agreement;

b. To use its best efforts to ensure the timely issuance of necessary permits and similar authorizing documents for use of the surface of the Contract Area; and

c. To cooperate with the Contractor in its efforts to obtain financing contemplated herein from banks or other financial institutions: Provided, That such financing arrangements will in no event reduce the Contractor's obligation on Government rights hereunder.

SECTION XII

ASSETS AND EQUIPMENT

12.1. The Contractor shall acquire for the Mining Operations only such assets that are reasonably estimated to be required in carrying out such Mining Operations.

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12.2. All materials, equipment, plant and other installations of a movable nature erected or placed on the Contract Area by the Contractor shall remain the property of the Contractor. The Contractor shall have the right to remove and re-export such materials and equipment, plant and other installations from the Philippines, subject to existing rules and regulations. In case of cessation of Mining Operations on public lands occasioned by its voluntary abandonment or withdrawal, the Contractor shall have a period of one (1) year from the time of cessation within which to remove its improvements; otherwise, all social infrastructures and facilities shall be turned over or donated tax free to the proper government authorities, national or local, to ensure that said infrastructures and facilities are continuously maintained and utilized by the host and neighboring communities.

SECTION XIII

EMPLOYMENT AND TRAINING OF PHILIPPINE PERSONNEL

13.1. The Contractor agrees to employ, to the extent possible, qualified Filipino personnel in all types of mining operations for which they are qualified; and after Commercial Production commences shall, in consultation and with consent of the Government, prepare and undertake an extensive training programme suitable to Filipino nationals in all levels of employment. The objective of said programme is to reach within the timetable set forth below the following targets of "Filipinization:"

	Unskilled (%)	Skilled (%)	Clerical (%)	Professional (%)	Management (%)
Year 1	100	100	100	75	75
Year 3	100	100	100	80	80
Year 5	100	100	100	90	90
Year 7	100	100	100	95	95
Year 10	100	100	100	95	95
Year 15	100	100	100	00	95

13.2. Cost and expenses of training such Filipino personnel and the Contractor's own employees shall be included in the Operating Expenses.

13.3. The Contractor shall not discriminate on the basis of gender and shall respect the right of women workers to participate in policy and decision-making processes affecting their rights and benefits.

SECTION XIV

ARBITRATION

14.1. The Government and the Contractor shall consult with each other in good faith and shall exhaust all available remedies to settle any and all disputes or disagreements arising out of or relating to the validity, interpretations, enforceability, or performance of this Agreement before resorting to arbitration as provided for in Section 14.2. below.

14.2. Any disagreement or dispute which can not be settled amicably within a period of one (1) year from the time the issue is raised by a Party shall be settled by a tribunal of three (3) arbitrators. This tribunal shall be constituted as follows: one to be appointed by the Contractor and the other to be appointed by the Secretary. The first two appointed arbitrators shall consider names of qualified persons until agreement on a mutually acceptable Chairman of the tribunal is selected. Such arbitration shall be initiated and conducted pursuant to Republic Act No. 876, otherwise known as the "Arbitration Act."

In any event, the arbitration shall be conducted applying the substantive laws of the Republic of the Philippines.

14.3. Each party shall pay fifty percent (50%) of the fees and expenses of the Arbitrators and the costs of arbitration. Each party shall pay its own costs and attorney's fee.

SECTION XV

SUSPENSION OR TERMINATION OF CONTRACT, TAX INCENTIVES AND CREDITS

15.1. This Agreement may be suspended for failure of the Contractor: (a) to comply with any provision or requirement of the Act and/or its implementing rules and regulations; (b) to pay on time the complete taxes, fees and/or other charges demandable and due the Government.

15.2. This Agreement terminates or may be terminated for the following causes: (a) expiration of its term, whether original or renewal; (b) withdrawal from the Agreement by the Contractor; (c) violation by the Contractor of the Agreement's terms and conditions; (d) failure to pay taxes, fees/or charges or financial obligations for two (2) consecutive years; (e) false statement or omission of facts by the Contractor; and (f) any other cause or reason provided under the Act and its implementing rules and regulations, or any other relevant laws and regulations.

15.3. All statements made in this Agreement shall be considered as conditions and essential parts hereof, and any falsehood in said statements or omission of facts which may alter, change or affect substantially the fact set forth in said statements shall be a ground for its revocation and termination.

15.4. The Contractor may, by giving due notice at any time during the term of this Agreement, apply for its cancellation due to causes which, in the opinion of the Contractor, render continued mining operation no longer feasible or viable. In this case, the Secretary shall decide on the application within thirty (30) days from notice: Provided, That the Contractor has met all the financial, fiscal and legal obligations.

15.5. No delay or omissions or course of dealing by the Government shall impair any of its rights under this Agreement, except in the case of a written waiver. The Government's right to seek recourse and relief by all other means shall not be construed as a waiver of any succeeding or other

default unless the contrary intention is reduced in writing and signed by the party authorized to exercise the waiver.

15.6. In case of termination, the Contractor shall pay all the fees and other liabilities due up to the end of the year in which the termination becomes effective. The Contractor shall immediately carry out the restoration of the Contract Area in accordance with good mining industry practice.

15.7. The withdrawal by the Contractor from the Mineral Agreement shall not release it from any and all financial, environmental, legal and fiscal obligations under this Agreement.

15.8. The following acts or omission, *inter alia* shall constitute breach of contract, upon which the Government may exercise its right to terminate the Agreement:

a. Failure of the Contractor without valid reason to commence Commercial Production within the period prescribed; and/or

b. Failure of the Contractor to conduct mining operations and other activities in accordance with the approved Work Programs and/or any modification thereof as approved by the Director.

15.9. The Government may suspend and cancel tax incentives and credits if the Contractor fails to abide by the terms and conditions of said incentives and credits.

SECTION XVI

OTHER PROVISIONS

16.1. Any terms and conditions resulting from repeal or amendment of any existing laws or regulation or from the enactment of a law, regulation or administrative order shall be considered a part of this Agreement.

16.2. Notice

All notices, demands and other communications required or permitted hereunder shall be made in writing, telex or telecopy and shall be deemed to have been duly given notice, in the case of telex or telecopy, if answered back or confirmation received, or if delivered by hand, upon receipt or ten days after being deposited in the mail, airmail postage prepaid and addressed as follows:

If to the Government:

THE SECRETARY
Department of Environment and Natural Resources
DENR Building, Visayas Avenue
Diliman, Quezon City

If to the Contractor:

THE PRESIDENT
Atlas Consolidated Mining and Development Corporation
7th F, Quad Alpha Centrum No. 125 Pioneer Street
Mandaluyong City, Metro Manila

Either party may substitute or change such address on notice thereof to the other party: Provided, That the Contractor shall, in case of any change of address during the term of this Agreement, notify the Director in writing. Failure to do such notification shall be deemed as waiver by the Contractor to be informed about any communications as provided in Section 16.2 above.

16.3. Governing Law

This Agreement and the relation between the parties hereto shall be governed by and construed in accordance with the laws of the Republic of the Philippines. The Contractor hereby agrees and obliges itself to comply with the provisions of the Act, its implementing rules and regulations and other relevant laws and regulations.

16.4. Suspension of Obligation

a. Any failure or delay on the part of any party in the performance of its obligation or duties hereunder shall be excused to the extent attributable to *Force Majeure* as defined in the Act: Provided, That the suspension of Mining Operations due to *Force Majeure* causes shall be subject to approval by the Director.

b. If Mining Operations are delayed, curtailed or prevented by such *Force Majeure* causes, then the time for enjoying the rights and carrying out the obligations thereby affected, the term of this Agreement and all rights and obligations hereunder shall be extended for a period equal to the period involved.

c. The Party, whose ability to perform its obligations is affected by such *Force Majeure* causes, shall promptly give Notice to the other in writing of any such delay or failure of performance, the expected duration thereof and its anticipated effect and shall use its efforts to remedy such delay, except that neither Party shall be under any obligation to settle a labor dispute: Provided, That the suspension of obligation by the Contractor shall be subject to prior approval by the Director.

16.5. Amendments

This Agreement shall not be annulled, amended or modified in any respect except by mutual consent in writing of the herein parties.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement, as of the day and year first above written

THE REPUBLIC OF THE PHILIPPINES

BY:

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ENR-016089

JOSE L. ATIENZA, JR.
Secretary
Department of Environment and Natural Resources

ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION AND ANATOLIA JACA, ASTERIO BUQUERON, CRISTETA C. BAGANO, LUCILA PASCUAL, MERCEDES AYTONA, REGINA DE VERA, RICARDO A. VERCHES AND BIGA COPPER MINES, INC. AS REPRESENTED BY ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION

TIN: 000-154-572-000

BY:

ALFREDO C. RAMOS
Chairman and President

SIGNED IN THE PRESENCE OF:

R. V. Quintos
(Signature over Printed Name)

(Signature over Printed Name)

ACKNOWLEDGMENT

Republic of the Philippines)
Quezon City) s s

Before me, a Notary Public for and in the City of Quezon, personally appeared **JOSE L. ATIENZA, JR.**, with Community Tax Certificate No. 16461275 issued on February 05, 2008 at QUEZON CITY, in his capacity as Secretary of the Department of Environment and Natural Resources, and **MR. ALFREDO C. RAMOS**, with Community Tax Certificate No. 12227778 issued on January 02, 2008 at MANILA, in his capacity as Chairman and President of Atlas Consolidated Mining and Development Corporation, both known to me and to me known to be the same persons who executed the foregoing instrument consisting of twenty-nine (29) pages, including this acknowledgment page, and acknowledged to me that the same is their voluntary acts and deeds.

IN WITNESS WHEREOF, I have hereunto set my hand and affix my notarial seal, this 10th day of July 2008.

ANSELMO C. ABUNGAN
Notary Public
UNTIL December 31, 2008
PTR No. 9915746 1/11/08 QC

Doc. No. 145
Page No. 29
Book No. VII
Series of 2008

CERTIFICATE OF REGISTRATION
Mines and Geosciences Bureau
Region VII, Mandaue City

The Registration fee therefore having been paid, the foregoing instrument was filed for record at 9:49 A.M. on August 1, 2008 and has been recorded in Book No. 1 of the records of MINERAL PRODUCTION SHARING AGREEMENT No. 264-2008-VII of this Region on page 221, Document No. 15

Registration fee paid under Official Receipt No. 4081013 in the amount of ~~P20,000~~.00 dated August 1, 2008.

ROGER A. DE DIOS
OIC-Regional Director

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emb7@emb.gov.ph emb_region7@yahoo.com

ENVIRONMENTAL COMPLIANCE CERTIFICATE

(07 06 1_ - 29 0278 0120)

The **ENVIRONMENTAL MANAGEMENT BUREAU (EMB)** of the **DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES (DENR), REGION VII** hereby grants this **ENVIRONMENTAL COMPLIANCE CERTIFICATE (ECC)** to **ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION** for its proposed **SIGPIT CREEK AND BIGA PIT DISPOSAL FACILITIES PROJECT** located at **BARANGAYS DON CLIMACO AND DON ANDRES SORIANO, ATLAS MINE SITE, TOLEDO CITY, CEBU** after complying with the **ENVIRONMENTAL IMPACT ASSESSMENT (EIA)** requirements pursuant to P.D. 1586.

I. SCOPE AND COVERAGE:

This **Certificate** shall cover the proposed Sigpit Creek and Biga Pit Disposal Facilities with a total gross area of Two Hundred Fifty (250) Hectares located within the existing Atlas Mining Concession Area. The Sigpit Creek Disposal Facility is anticipated to be partially filled up with mine tailings up to the +150 meters elevation that will be used for a period of two years from the commencement of the mining operations of the firm with the following facilities, to wit: Earth dike (dam) at the downstream terminal, Gravity launder delivery system, diversion tunnels at Casoy, Tailings water recycling system and Sigpit dam sedimentation basin. On the other hand the Biga Pit Disposal Facility has an impounding capacity of Two Hundred Fifty Two Million (252,000,000) Tons of mine tailings which consists of consisting of a tailing pump house, reinforced concrete launder, concrete sump pit, and tailing disposal and water recycling pipelines.

II. CONDITIONS:

A. Proponent's Environmental Compliance

A.1 General Conditions:

1. That the proponent shall comply with the following:

PD 1586 (Philippine Environmental Impact Statement System)

- That all mitigating/enhancement and rehabilitating measures enumerated in the construction and operation phase of the submitted Environmental Management Plan (EMP) and specified in this Certificate should be strictly implemented. ***(Refer to Annex A, B, C and D for the detailed EMP of Sigpit Area, Onggom Area, Biga pit and EIARC recommended mitigating measures respectively)***
- That the proponent should make available a budget of **Two Hundred Million Pesos (₱ 200,000,000.00)** based on the project schedule as indicated in the submitted Environmental Management Plan (EMP) Summary for the implementation of the project and proposed mitigating measures. An accomplishment report on the implemented mitigating measures and corresponding cost of the EMP activities shall be submitted to this Office on a quarterly basis for monitoring purposes;
- That no other activities should be undertaken other than what were stipulated in the submitted PEPRMP document. Should there be any expansion shall be subject to another EIA requirements;
- That project proponent should be held accountable for whatever damages to life, property, and environment caused by the project all throughout its lifespan;
- That proponent should allow entry of EMB-7 field personnel into the project site at all times to conduct tangible monitoring and to validate project's compliance to the ECC conditions stipulated therein;
- That in case of abandonment, the proponent shall notify this Office three (3) months prior to the abandonment and submit therewith their abandonment mitigation plan;
- Transfer of ownership of his project carries the same conditions in this certificate for which written notification should be made by herein grantee to this Office within fifteen (15) days from such transfer;

RA 8749 Clean Air Act of 1999

- That a Permit to Operate (P/O) for air pollution source equipment and its corresponding pollution control device should be secured from this Office prior to operation;

RA 9003 Ecological and Solid Waste Management Act of 2000

- That effective solid waste management should be provided in case the government cannot accommodate the generated waste. Management Plan of same should be submitted to this Office prior to implementation. Solid waste management scheme such as segregation and recycling the biodegradable and non- biodegradable as indicated in the submitted Environmental Management Plan shall be implemented; and
- Observe proper solid waste management (segregation, reuse/recycling);

RA 9275 Clean Water Act of 2004

- That effluent from the Wastewater Treatment acilities (WTF) should conform to the standards set forth by Clean Water Act. Should monitoring indicate exceedance of the environmental quality standards, the proponent should be liable to provide effective remedial measures immediately; and
- Discharge Permit (D.P.) for wastewater treatment facility should be secured from this Office prior to installation and operation.

2. That development and operational activities of the proposed project should be included in the monitoring activities of the existing /active Atlas Consolidated Mining and Development Corporation Multi-Partite Monitoring Team (ACMDC-MMT);

3. **That the proponent shall set-up an Environmental Unit who shall continue to competently handle the environmental-related aspects of the project. In addition to the monitoring requirements as specified in the Environmental Monitoring Plan, the EU shall also:** Monitor actual project impact vis-à-vis the predicted impacts and management measures in the IEE; Accordingly recommend revisions to the

Environmental Management plan (EMP) as necessary; Ensure that the appropriate post-assessment permits are inplace; Ensure that monitoring and reporting are carried out as required; and Assure compliance with the conditions of the approved ECC.

A.2 Special Conditions:

4. That planting of appropriate tree species shall immediately be affected within the project area as planned to serve as buffer and to compensate the damaged vegetation caused by the project implementation. It shall be maintained throughout the lifespan of the project;
5. That a 2' x 4' billboard containing this message " Notice to the Public, This project (title of the project) of (name of proponent) has been issued an Environmental Compliance Certificate (ECC Number) by the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR) , Region VII on (date of issue)" must be installed at entry/exit points of the project site facing the road to inform the general public of the ECC issuance within Thirty (30) days upon receipt hereof. The proponent shall post this approved ECC in a Barangay bulletin board once within Thirty (30) days upon receipt hereof. An accomplishment report including pictures shall be submitted to this Office as proof of compli nce of the required posting within the given period. Concerned government agencies shall be provided copy of this Certificate, such as: DOH, DOLE, NWRB/LOCAL WATER DISTRICT, CENRO/PENRO and LGU concerned Thirty (30) days upon receipt thereof;

Non-compliance with all conditions under (A) is a ground for issuance of Notice of Violation

B.1 General Conditions:

6. That the proponent should comply all the necessary permits from other government agencies mandated to implement the following laws, such as: R.A. 7160 "Local Government Code of Philippines, P.D. 856 "Sanitation Code of the Philippines"; National Irrigation Administration, RA 7942 "Mining Act" P.D. 1067 "Water Code of the Philippines" and P.D. 442 "Labor Code of the Philippines"

B.2 Special Conditions

7. That close monitoring should be undertaken by the project proponent to maintain a high level of safety and efficiency at all stages of the project implementation and to immediately address any environmental address environmental hazard/change at any such stage;
8. That this **Certificate** supersedes **ECC No. 07 06 05 – 08 0079 104** dated **May 08, 2006** issued by this Office and that this ECC may be amended or modified by this Office as the circumstances warrant or as the needs arises, with due notice to the project proponent;

C. Recommendation to Address Cumulative Impacts

9. That the project proponent should comply all the recommendation of the EIA Review Committee in terms of the substantive requirements;
   - ✓ Residents at Sigpit Creek and onggom Creek area shall be relocated and compensated adequately. Project activities shall not start before the acquisition of all lots affected and the necessary relocation activities are fully completed;
   - ✓ Water sources, which have been used before by local people along Onggom Creek might not be accessible anymore with increased water levels of the str am; and
   - ✓ Update the rainfall data given in the submitted PERMP document;
10. That the proponent shall commit that both the quantity and quality of water needed by National Irrigation Administration (NIA) for its irrigation will not be affected;

Non compliance of all conditions under (B and C) does not result in any issuance of NOV

THAT THIS ECC SHOULD NOT BE MISCONSTRUED AS A PERMIT; RATHER A SET OF CONDITIONALITIES WHICH SHOULD BE FOLLOWED BY THE PROJECT PROPONENT IN ALL STAGES OF THE PROJECT IMPLEMENTATION IN ORDER TO MITIGATE POTENTIAL ADVERSE IMPACTS ON THE ENVIRONMENT.

Given this 29th day of December, 2006.

Approved by:

ALAN C. ARRANGUEZ
OIC Regional Director

Recommending Approval:

WILLIAM P. CUÑADO
Chief, EIA Division

Conforme:

RODRIGO C. CAL
AVP & Resident Manager

That this Certificate should be posted in a conspicuous location clearly visible to the public and shall be adequately framed or otherwise protected against damage.

PROCESSING FEE: Php 2,100.00 O.R.#: 6092719 DATE: 12/29/06

ANNEX 2: Copies of ECCs

Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
Region VII

December 28, 2011

RECEIVED
JAN 30 2012
BY:

MR. RODRIGO C. CAL
VP and Resident Manager
Carmen Copper Corporation
Don Andres Soriano, Toledo City, Cebu

SUBJECT: ECC AMENDMENT

Dear Mr. Cal:

This refers to your amendment request for the design's changes of the Tailings Disposal Facility (TDF) System and the Biga Pit Tailings Disposal Facility Impounded Water Relief Project for your ATLAS MINES TAILINGS DISPOSAL FACILITY PROJECT which is covered by ECC NO. 07 06 12-29 0278 0120, located in Barangay Don Andres Soriano, City of Toledo, Province of Cebu, Region VII.

After careful technical assessment and evaluation on your request with supporting data and information, this Office has determined that your request is meritorious. Related thereto, this Office hereby decided to amend the ECC to read as follows:

PROJECT DESCRIPTION

Formerly:

This Certificate shall cover the proposed Siggit Creek and Biga Pit Disposal Facilities with a total gross area of Two Hundred Fifty (250) hectares located within the existing Atlas Mining Concession Area. The Siggit Creek Disposal Facility is anticipated to be partially filled up with mine tailings up to the +150 meters elevation that will be used for a period of two years from the commencement of the mining operations of the firm with the following facilities, to wit: Earth dike (dam) at the downstream terminal, Gravity launder delivery system, diversion tunnels at Casoy, Tailings water recycling system and Siggit dam sedimentation basin. On the other hand the Biga Pit Disposal Facility has an impounding capacity of Two Hundred Fifty Two Million (252,000,000) tons of mine tailings which consists of a tailing pump house, reinforced concrete launder, concrete sump pit, and tailing disposal and water recycling pipelines.

Amended

The ECC covers the ATLAS MINES TAILINGS DISPOSAL FACILITY PROJECT (formerly: Siggit Creek and Biga Pit Disposal Facilities Project) with a total surface area of Four Hundred Three point Forty Five (403.45) hectares located in Barangays Biga and Media Once, City of Toledo, Province of Cebu, Region VII with the following geographic boundaries: East Longitude 123°48'00" to 123°48'38" North Latitude 10°20'00" and 10°20'30".

The project includes the development and operation components of the following:

1. HANDLING OF TAILINGS:
   A. Existing tailing Transmission Line from CARCON to BIGA Pit – Three point Seven (3.7) kilometers;
   B. Emergency Tailings Pond – Zero point Seventy One (0.71) hectare;

2. STORAGE OF TAILINGS:
   A. Biga Pit;

ECC No.: 07 06 12-29 0278 0120
Project Name: Atlas Mines Tailings Disposal Facility Project
Proponent Name: Carmen Copper Corp.

07 06 12-29 0278 0120

Banilad, Mandaue City, Cebu, Philippines, 6014
Tel. Nos. (+6332) 3469426,3453905 Telefax No. 3461647
Email: emb7@yahoo.com

3. HANDLING/TREATMENT OF WATER OVERFLOW
   A. Lime Injection Plant;
   B. Decant Tower;
   C. Wastewater Treatment Facilities (WTF) consisting of series Twelve (12) units settling pond; and
   D. Pipeline for Water Relief Overflow:
      i. Pipeline through Bigacon Tunnel Conveyor – Zero point Twenty Three (0.23) hectares;
      ii. Bigacon to Malubog Dam – Three (3) hectares;
      iii. Malubog Dam to Sedimentation Pond (stretch of Upper Sigpit) – Five point Eighty Five (5.85) hectares;

4. Recycling and disposal of water overflow:
   A. Sigpit Sedimentation Pond - One point Twenty Eight (1.28) hectares as indicated in the submitted EPRMP document;
   B. Sigpit dam for disposal point of water overflow; and
   C. Pipeline for recycled water leading to the existing water tank with a storage capacity of Fifty Thousand Four Hundred Fifty Six (50,456) cubic meters.

It has a total estimated volume of available void between two horizons of One Hundred Sixty Eight Million Seven Sixteen Thousand (168,716,000) Cubic Meters, equivalent to an impounding capacity of Two Hundred Fifty Two (252) million tailing tonnages at peak milling capacity of Forty two Thousand (42,000) metric tons of ore per day of Common Concentrator.

Additional ECC Conditions:

1. The proponent shall ensure that all commitments, appropriate mitigating/enhancement measures and monitoring requirements especially those contained in the updated IMP and EnMoP in the EPRMP document/Annex A, its modifications and additional information as approved by the EMB during the EPRMP review shall be instituted and strictly implemented throughout the project implementation;

2. Project proponent should implement all the recommended mitigating measures as stated in updated Impact Management Plan (IMP) prior to project activities identified that contribute significant impact to the surrounding/immediate vicinity of the project site;

3. The proponent shall make available appropriate budget based on the project schedule as indicated in the submitted updated Impact Management Plan (IMP) Summary for the implementation of the project and proposed mitigating measures in the construction and operational phase. An accomplishment report on the implemented mitigating measures and the corresponding cost of the IMP activities shall be submitted to this Office on a quarterly basis for monitoring using CMR format;

4. That Biga Pit Tailings Storage Facility (TSF) shall be automatically stop its operation when it will reach its impounding capacity of Seventy Five (75) Million Dry Metric Tons of tailing from current elevation of Two Hundred Thirty Six point Zero Three (236.03) meters to Three Hundred Thirty Seven point Thirty Five (337.35) meters or shall not exceed its operating life of Eight (8) years or whichever come first provided that unless appropriate measures to increase its capacity will be designed and the requirements for a corresponding ECC amendment has been complied with;

5. The proponent shall establish additional nursery program for the seedling production of One Million Eight Thousand Six Hundred Twenty Five (1,008,625) in support to the Green Philippines Master Plan which will be utilized for tree planting activities. Planting of appropriate tree species shall be implemented within the project area or any potential area as planned to serve as buffer and to compensate the removal of vegetation caused by the project implementation. The planted trees shall be maintained throughout the lifespan of the project. Approved Work and Financial Program for the seedling production and tree planting and growing activities shall be submitted within three (3) months upon receipt thereof;

6. That fish monitoring activities in the receiving River and coastal/sea area of the project shall be added in the monitoring activities of MMT which will be included in the submission of CMR and CMVR reports;

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Project Name: Atlas Mines Tailings Disposal Facility Project
Proponent Name: Cantoc Copper Corp.

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07 06 12-28 0278 0120

7. The proponent shall set-aside adequate Environmental Guarantee Fund (EGF) to compensate any flood damages caused by tailings discharge to the receiving waterbodies such as rivers and coastal/sea areas, to be submitted to this Office within Ninety (90) days from receipt thereof;

8. Submit an Annual Project Environmental Risk Categorization or as soon as or after the final siting and design of facilities have been decided whichever comes earlier (using Annex 2-7d of the Revised Procedural Manual). An Environmental Risk Assessment with Climate Change Adoptation Report shall be submitted in yearly basis; and

9. Undertake a continuing Information, Education and Communication (IEC) program to explain to all stakeholders the updated EMMoP and the conditions of this ECC as well as an update of project status including any significant changes on the updated EMMoP and over-all performance against this ECC, and the updated Social Development Program.

The subject amendment will form part of the document on file.

Recommending Approval:

WILLIAM P. CUNADO
OIC-CHIEF, EIAMD

Approved By:

FERNANDO P. CHILILAN
Regional Director

ECC No.: 07 06 12-29 0278 0120
Project Name: Atlas Mines Tailings Disposal Facility Project
Proponent Name: Cantoc Copper Corp.

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